



**MODEL**

**SERVO-OPERATED FOWLER FLAPS**

# AIRPLANE

**NEWS**

48120 March 1997

THE WORLD'S PREMIER R/C MODELING MAGAZINE

**ROBOTICS**

Frontier of  
Aerial Automation

**COMPETITION**

**Paint  
Like  
an  
Expert**

Laying the  
foundation — page 48

**SILENT  
SHOWDOWN!**

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**FIELD & BENCH REVIEWS**

- KYOSHO Spacewalker • CERMARK Porterfield
- MAJOR HOBBIES Mystery Ship

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# MODEL AIRPLANE NEWS

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ON THIS PAGE: top—Tom Hunt's Spitfire with contra-rotating props on final at KRC (photo by Larry Marshall); center—competitors at the International Aerial Robotics Competition test their entry; bottom—Chuck Anderson's 2-meter competition sailplane sports winglets (photo by Dave Garwood).

ON THE COVER: main photo—Kyosho's Spacewalker in flight (photo by Walter Sidas). Insets—a B-17 at KRC about to set down (photo by Larry Marshall); competitors at the Visalia Fall Soaring Festival (photo by Mike Lee).

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# EDITORIAL

by TOM ATWOOD

## SELIG AIRFOIL UPDATE

Michael Selig and his team at the University of Illinois at Urbana-Champaign continue to forge ahead in their research on model-size airfoils. In recent years, Michael's work has been particularly influential in the sailplane segment: of the top 20 pilots at the 1996 AMA/LSF Nats, 70 percent used Selig or Selig-Donovan airfoils. Through his continued efforts, a growing roster of airfoils—many newly designed—have been tested, and the results have been placed in the public domain for use by all in our sport. This data is available on the Web and in hard copy (details below).

Will models using the best of the recommended airfoils fly noticeably better? Can modelers build wings accurately enough to enjoy the improved performance suggested by wind-tunnel results? We thought it would be useful to have an expert comment on these often debated questions, so we inquired with Michael.

Michael noted that superior airfoils will stall more gently and at lower speeds—performance characteristics important to power planes. They can offer faster straightline speeds and a greater climb rate. Problematic airfoils may stall sharply or exhibit a narrow speed range. "Modern" airfoils, he explained, offer greater maneuverability—tighter turning, lower landing speeds, higher roll rates and overall smoother handling (notably, the Top Flite P-47 uses two Selig airfoils and flies well).

Recent tests of several airfoils used in commercially available power plane kits showed a surprising range in performance. In his opinion, the differences should be apparent in side-by-side flight tests, assuming everything but the airfoil was held constant.

Michael commented that the better-performing airfoils have a more gradual

pressure distribution over their upper surfaces. Such airfoils are more forgiving of building errors. But how accurately must they be built?

Uniform errors in thickness of 10 to 20 thousandths of an inch (for a 12-inch-chord wing) don't affect performance (10 thousandths is the thickness of two to three pieces of paper). Performance can begin to be adversely affected if errors in contour are asymmetric, i.e., too thick up front and too thin near the leading edge. Differences front to back of 20 thousandths can produce a noticeable increase



Left to right: Chris Lyon, Philippe Giguère and Michael Selig confer at the UIUC wind tunnel.

in drag and affect stall behavior. A 60 thousandths bias ( $1/16$  inch) would create a different airfoil.

According to Michael, a careful scratch-builder using a good sanding block and filler can build a fully-sheeted, balsa-and-ply wing to within 5 thousandths of a perfect airfoil. The trick is to place a template over the top of the airfoil and hold the wing/template combination up to a bright light to see where glints of light peek through. As for foam wings, he noted that cutting error and/or overly extended vacuum bagging (which crushes foam) can cause variations in thickness of up to 30 thousandths. Molded airfoils are, of course, the most accurate. The bottom line: if you want the best performance, you'll need to build extremely carefully or go with a molded wing.

Future studies will include research on airfoils, flap and control-surface deflections, tail configurations, winglets, wing/fuselage interfaces and more. The latter topics (3D effects) are envisioned to

begin two to three years out, while work on two-dimensional airfoils will be ongoing. The research has been possible only because of the generous support of the modeling community. In turn, we all indirectly benefit as kit manufacturers adopt the new airfoils. If you wish to support these studies (I'm sending a personal check for \$50), send your donation (checks payable to Univ. of Illinois, AAE Dept., and note "Selig wind-tunnel testing/AAE unrestricted funds") to Prof. Michael Selig, Dept. of Aero. and Astro. Eng., University of Illinois at Urbana-Champaign, 306

Talbot Laboratory, 104 S. Wright St., Urbana, IL 61801-2935.

Looking for more information? Michael's group recently published Volumes 1 and 2 of "Summary of Low-Speed Airfoil Data." A third volume on airfoils designed for powered sport models will be published in early '97. These and the earlier "Airfoils at Low Speeds" (Soartech 8, 1989) are available at a very reasonable price from Soartech, c/o H. A. Stokely, 1504 N. Horseshoe Cir., Virginia Beach, VA 23451; email: herkstok@aol.com. For more details on all of the above, visit Michael's website at: <http://www.uiuc.edu/ph/www/m-selig>.

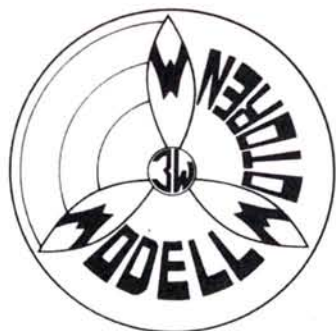
### ROBOTS, SAILPLANES AND ELECTRICS

This month, we cover two silent model meets. The Visalia sailplane competition is an intense competition of duration and precision flying of these majestic birds. KRC is the premier electrics event in North America. No hot competition here, but it's a weekend where just about anything that can be powered by an electric motor flew over the site, while the flyers and spectators had the time of their lives.

Rob Michaelson discusses the 1996 International Aerial Robotics Competition and we get a glimpse at autonomous flying devices that know where they are, are capable of assessing many things about their environment and can apply their skills to problem-solving tasks. Is this the future of our hobby? In any case, these are some mighty neat machines.

—Tom Atwood +





## A Proven Winner!



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# AIRWAVES

**WRITE TO US!** We welcome your comments and suggestions. Letters should be addressed to "Airwaves," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606; email: man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous number of letters we receive, we can not respond to every one.

## FAI WORLD CHAMPIONSHIPS UPDATE

This concerns the article I wrote on the FAI Scale World Championships in the January issue. The weights and dimensions of the aircraft for competition through 1996 are listed, but there have been several rule changes. At the last FAI subcommittee meeting, several international representatives (including our own, Bob Underwood) pushed for sweeping rule changes, including the following, which were passed (taken from the National Association of Scale Aeromodelers' newsletter, "Replica," Cliff Tacie, editor):

For F4C Radio Control Scale

- 10 kg. or 22.05 lb. weight limit.
- No wing loading requirement.
- Electric models will be weighed "without fuel" (batteries used for power source).
- It was agreed by those present that a 4-year freeze would be imposed relative to any request for additional weight increase.
- Gas and propane turbine jet engines are now allowed.

With these rule changes, 63 percent of the models that competed at the Top Gun Invitational in '96 are ready to compete in the FAI Team Qualifier in Muncie on July 7 to 10.

For F4B Control-Line Scale

- K factors are revised. Realism in flight is subdivided into five sections: engine noise, speed of the model, stability and trimming, size of the figures and flight elegance.
- Optional demonstrations added.

These are not all of the changes, but some of the major ones. I'm sure many more modelers who have bypassed the FAI Scale Competition in the past will now take a second look at competing in the USA Team Qualifier.

The static score of Max Merckenschlager should have been 1,768 instead of 768.

The new FAI rule book will be published after January 1997 and should be available from the AMA Competition Dept., (317) 287-3156; website: <http://www.modelaircraft.org>.

STAN ALEXANDER  
Nashville, TN



## ADDRESS PLEASE

I bought plans for your Extra 3.25 (FSP01931) designed by Rich Uravitch. When I sent my check to Rich for the plastic canopy and cowl, the money was returned. Is Rich still in the business of selling plastic parts for *Model Airplane News* plans? Please help!

MARC D'ANTONIO,  
Terryville, CT

Marc, yes, Rich Uravitch is indeed still out there selling plastic parts for the plans he designed for *Model Airplane News*. Rich did, however, move to a new address. He also has plastic parts for his Fokker D-VII (FSP04852), LTV A-7 Corsair II (FSP01951), RAF SE 5a (FSP03852) and the OV-10 Bronco (FSP11951). If any other readers are looking for plastic parts for these plans, Rich can be reached at the address below. We will be changing the address listed on his designs in the *Model Airplane News* plans library to: Rich Uravitch, 1094 Glendale Ave. NW, Palm Bay, FL 32907; (407) 728-0486. GY



## AEROPLANES ON THE WEB

This past September, I attended the 30th annual WW I Jamboree at Rhinebeck, NY. Though it rained everywhere except at the

aerodrome itself, the event went off without a hitch. I heard they had over 700 flights listed during the weekend. I hope you plan to cover this event in your magazine, but what's more, I hope you can tell your readers that information on the aerodrome and the jamboree are on the Web. You can get the registration form for the jamboree from the Rhinebeck Aerodrome's website at: <http://www.mainstream.com/rhinebeck.html>.

GEORGE UNGER,  
Flemington, NJ

George, we plan to cover the 30th annual Rhinebeck, WW I Jamboree in our April '97 issue. Yes, despite the poor weather, Rhinebeck posted an amazing 758 total flights for the weekend, 551 of which were in their popular Mission event. It has been a while since we covered the flying circus of fun at Rhinebeck and in the April issue, we'll include a sidebar by Dick Allen on the history of the Jamboree. Dick was one of the principal organizers of the event and was the Jamboree's first CD.

The Rhinebeck Webpage is a great site for anyone, modeler or not, interested in early aviation. There are many color photos of the antique aircraft in the museum's collection as well as a schedule of events at the aerodrome. The registration form for the Jamboree is hotlinked to the page and can be printed out, making it easy to get your registration in as soon as possible. Check out our April issue for more information on the aerodrome and the 30th annual Jamboree. GY

## LOOKING FOR DEAN

I need help from your readers. Does anybody know the whereabouts of W.A. "Bill" Dean?—former president of Skybooks Intl., former designer for Jetco, I believe, and one-time designer for Britain's Keil Kraft? A phone number would be helpful. A note or call would be appreciated.

JIM NEWMAN  
4 Cleveland Ter., Hobart, IN 46342;  
(219) 942-2571.





# AirSCOOP

by CHRIS CHIANELLI

*New products or people behind the scenes; my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!*



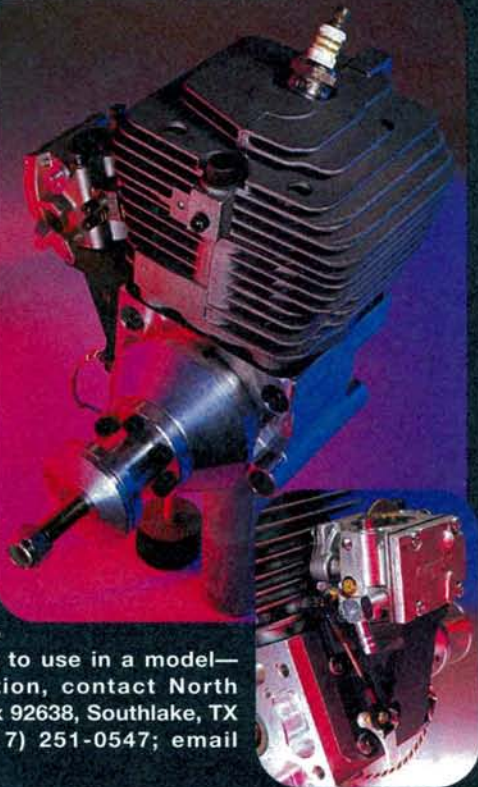
**W**hen preparing the surface of your model for finishing, it's those tight spots, narrow fillets, delicate details and hard-to-reach corners that cause considerable consternation. With the Flex-i-File and Flex-Pad (with newly angled tip), the process of surface preparation can now

## In a Tight Spot?

be enjoyed, instead of endured. Both Flex-i-File refills and Flex-Pads come in color-coded coarse, medium, fine and extra-fine grades. The Flex-Pad set also comes with a triple-grit polisher/finisher for clear and opaque plastic surfaces. Flex-Pads and Flex-i-Files are sold separately or together as a set. For more information, contact Creations Unlimited Hobby Products, 4318 Plainfield Ave. NE, Dept. 160, Grand Rapids, MI 49505; (616) 363-1242.

## Quadra Aerrow 100XL

**I**t's been easily two years since North American Power R/C introduced their first Quadra 100. During this time, Quadra-Aerrow has been refining the design, and the result of this work is the new 100XL. This highly refined 6.4-pound (without muffler) version not only puts out approximately 11hp and 50 pounds of thrust on a 26x10 prop, but it is extremely smooth for an engine of this size, according to Quadra-Aerrow. The vibration levels are best around the 7,000rpm mark, the most usable part of a large ignition engine's torque band. The totally new induction-block/reed container allows the use of a larger-bore carburetor, which is part of the reason for the increased power. The linkage also comes as you see it here, ready to use in a model—thank you! For more information, contact North American Power R/C Inc., P.O. Box 92638, Southlake, TX 76092; (817) 251-0787; fax (817) 251-0547; email 102177.2456@compuserve.com.



**SR**Batteries announces the X<sup>440</sup>, a truly high-performance, ready-to-fly, electric sailplane. Made by X-Models for SR Batteries, the X<sup>440</sup> is a CNC computer-machined balsa and composite aircraft weighing only 10 ounces ready to fly, less radio and power system. The model comes built and covered with Oracover. Just install your servos and motor, and you're ready to go! Assembly takes less than an hour. The X<sup>440</sup> features pre-painted epoxy/glass fuselage with plug-in V-tail stabilizers and carbon-fiber spars, leading edge and pushrods. The 64.5-inch, two-piece wing has 442 square inches of area and utilizes the S3021 airfoil. Wing loading is an incredible 7.5 ounces per square foot, and aspect ratio is 9.4:1. This should be some performer, my friend. Recommended power is either a direct-drive, or better yet, gear-drive, Speed 400 or AP29 motor, which should easily give you at least 30-minute flights.

SR Batteries states, "The overall quality of the X<sup>440</sup> had to be seen to be appreciated. The fit and finish aren't just good; they're better than anything else you've ever seen! This is not just another ARF. This is truly an amazing aircraft that any modeler would be proud to own and fly." Price is \$199.95 plus shipping. For more information, contact SR Batteries Inc., P.O. Box 287, Bellport, NY 11713; (516) 286-0079; fax (516) 286-0901; email 74167.751@compuserve.com. Ask for Larry. He's a really nice guy.

# X<sup>440</sup>





# DAKOTA ELECTRIC

**T**his high-quality electric twin is pre-manufactured to the ARC (almost ready to cover) stage and requires a minimum of building time. It comes in three versions: U.S. Army (pictured), Lufthansa civilian and RAF. Designed for Speed 600-type motors (or .10 to .12 glow), this model has a 71.25-inch wingspan, is 45.25 inches in length and weighs 5 to 7 pounds ready to fly. Features are white, gel-coated, fiberglass fuselage, light-obechi sheeted wings, ABS nacelles, fuel tanks (glow version only) and hardware pack including landing gear. The suggested retail price is only \$299.95. For more information, contact Apicom Hobby Distributors Co., 520 W. 112th St., Ste. 9A-9, New York, NY 10025; phone/fax (212) 662-2829; orders (800) 704-9273.



## HAVE IT YOUR WAY

**C**onsidering all the time you spent on that beautiful scale project, doesn't it make sense not to cut corners at the last moment on surface markings? Well, doesn't it? You can get exactly what you want, and what the project deserves, as on this 1/6-scale Bf109 with custom-made transfers from Pro-Mark Model Graphics. Besides the long list of in-stock transfers Pro-Mark has—including rivets, panel lines and other surface detail—Pro-Mark will custom-make almost anything for you. While they have an extensive aviation library on hand and can work from their publications, Pro-Mark is used to working with modelers and their own documentation. They are ready and willing to work closely with you to make the dry-transfer markings that are precisely what you want. Contact them at Pro-Mark Model Graphics, 751 Airport Rd., Metropolis, IL 62960; (618) 524-2440; fax (618) 524-3617.



## MORE TIME FLYING—LESS TIME READING!

**H**ave you ever stopped yourself from buying a computer radio because you weren't into reading the phone-book-size manual that some of them come with? Worse yet, some are written with the assumption that you're more into writing computer programs than you are flying your model! Dynamic Modelling may have solved these problems with the introduction of the "Guide to Computer Radio Control Systems." This is an instructive textbook and comprehensive guide that complements all instruction manuals and covers all brands and all aspects of programmable computer radio systems. According to Dynamic Modelling, if you fly pattern, sailplanes, helicopters, fun-fly, or scale or are simply a sport pilot, this book will be a valuable addition to your library and will save you hours of time when it comes to understanding your radio's logic. Author Don Edberg, who has written three instruction manuals for Futaba and the aftermarket book "Programming the Futaba Super 7," has written this book in everyday-modeler, easy-to-understand English. It speaks directly to the needs of modelers and the practical uses of our computer radios. The intent of this book is to blend the understanding of computer radio operation with easy reading—an unusual combination that is most welcome. For more information, contact Dynamic Modelling, 4922 Rochelle Ave., Irvine, CA 92714-2941; (714) 552-1812; email 72417.2067@compuserve.com.



## Very Friendly at 86.2dB

**T**hunder Tiger's new GP .42 is designed to be an affordable, user-friendly sport engine for the first-time flier that, thanks to a newly designed, baffled, expansion-chamber muffler, produces only 86.2dB (by FAI standard test), according to the manufacturer. The GP .42 features ABC piston/sleeve technology and an air-bleed carburetor with a main needle valve that is angled back at 20 degrees to get fingers



farther away from the prop during adjustments. This very affordable engine carries Thunder Tiger's 3-year warranty. For more information, contact Thunder Tiger USA Inc., 2430 Lacy Ln., Ste. 120, Carrollton, TX 75006; (972) 243-8238; fax (972) 243-8255.

## Fire in the Sky

**L**ike everyone else, I love a model that flies well. But one that flies well and is easy to see makes me fly even better! The new Craze from Dymond Modelsport USA is an aerobatic performance glider that is highly prefabricated, and it's hot pink! The wings and elevator are pre-covered, and all pushrods, servo tray and motor mount (for Astro 05 or similar) are installed. A glow version is also available. Specs are wingspan, 63 inches; requires 4-channel radio; Dymond Max 6 or 05 motor; and 7 to 10 cells. For more information, contact Dymond Modelsport USA Ltd., 500 Court St., Park Falls, WI 54552; (715) 762-2710; fax (715) 762-2542; toll-free order line (888) 4FUN-FLY.



## December Summer



**T**he first Jets Over Argentina was a huge success. Left: Tango dancer Celia with BVM Maverick. (Buenos Aires certainly is beautiful!) Above: designed specifically for turbine power, BVM's new Bandit performed flawlessly every single time. Full event report coming soon.



## Does $E=MC^2$ @ 1/8 scale?

**U**nlike air density, it seems certain things, like Einstein's Theory of Relativity, may scale down within the space and time immediately occupied by a scale model moving at high speed. Stranger things can, and have, in my opinion, happened. During this past hurricane season, Top Gun promoter and scale aficionado Frank Tiano was doing some speed runs with his 1/8-scale F-86, which was recently refitted with the experimental

Russian Gorki/Shmirnikoff turbine that is equipped with the first ever

afterburner for models. On the morning of October 21, Frankie was diving at the speed trap, in full afterburner, when his craft got caught in a wind-shear downdraft, the kind that often gives birth to tornadoes. As the craft reached an unknown speed (1/8-scale speed, not full-scale, obviously) the fuselage seemed to compress when suddenly, the engine flamed out. The model was apparently ripped back into "real time" without a proper deceleration sequence. The permanent result, as you can see for yourself, was not a pretty sight. On a brighter note, the once portly 1/8-scale pilot (modeled after Frankie) was now a slender young man with a full head of hair. The F-86, rejuvenated 1/8-scale pilot and Frankie are currently all at NASA for testing and observation.







# Hints & KINKS

by JIM NEWMAN

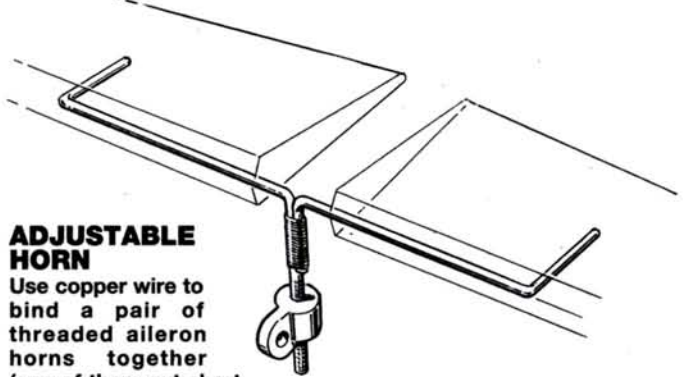
Model Airplane News will give a free one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o Model Airplane News, 100 East Ridge, Ridgefield, CT 06877-4606. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.



## A NEW SPIN ON IT

"Engine turning," as used on the *Spirit of St. Louis* cowl, is easily duplicated. Grind a pencil eraser to the diameter required, then spin it in a drill while gently touching it to the metal part. Hides scratches, etc., on metal landing gear and looks beautiful.

Manuel Suero,  
Pembroke Pines, FL



## ADJUSTABLE HORN

Use copper wire to bind a pair of threaded aileron horns together (one of them cut short as shown), then solder them. This can be used for elevators and flaps.

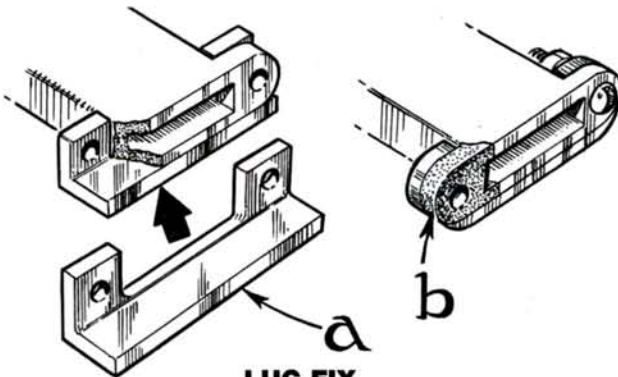
Alonso Araya, Concepcion, Chile



## ROLL 'EM UP

Mount an old roller blind on the overhead beams, then tape only the top edge of your plan to it. It will roll up neatly out of the way with just a tug of the cord. Wooden spacer blocks might be needed on the brackets.

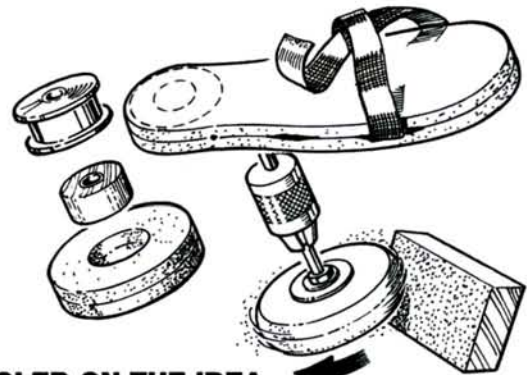
Skip and Celia Delius, Ballwin, MO



## LUG FIX

Shape a piece of aluminum angle (a), then screw it to the remaining good muffler lug. Pack the missing area (b) with metal-filled epoxy (from Ace Hardware, etc.), then when it has cured, file the whole assembly to shape. Do not remove the angle; it is a reinforcement.

Henry Loos Sr., Waterford, NY



## SOLED ON THE IDEA

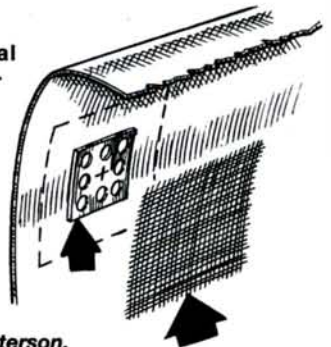
Cut new tires out of old beach sandals and mount them on an existing metal hub (or make a wooden hub out of a large dowel, then CA it into the tire). Spin the tire in a drill and use a sanding block to shape it. A wooden hub will need a metal bushing.

Hashem Waghighi, Shiraz, Iran

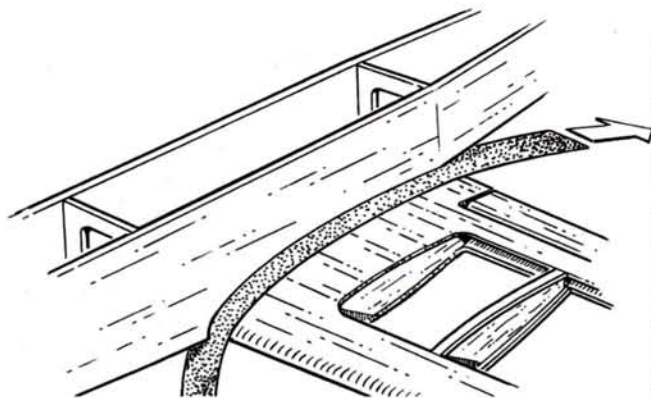
## ANTI-SPLIT

Glue perforated metal patches at the mounting-screw locations inside your fiberglass or plastic cowl, then cover the patches with a layer of fiberglass cloth. This stops the cowl from cracking around the screws and prevents the screws from tearing through the cowl.

Robert Peterson,  
Youngstown, NY



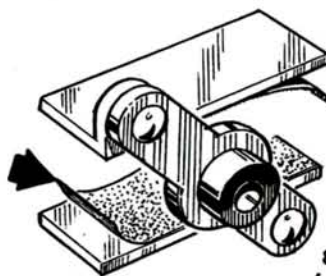




## NEAT SEAT

Have a helper keep the wing pressed to the wing saddle while you pull a strip of 320 sandpaper back and forth. Wing seating will fit like you won't believe. (Keep the smooth side of the paper in contact with the wing.)

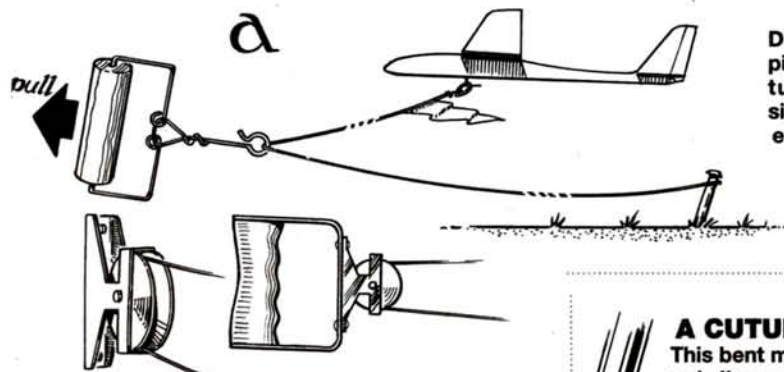
*Barry Packman, Loftus, Australia*



## SLIP-PROOF DRILL JIG

Glue sandpaper to the contact faces of your great little Robert Hinge Point drill jig to stop it from sliding while you drill hinge holes. Lee recommends 80-grit.

*Lee Bates, Tolovana Park, OR*

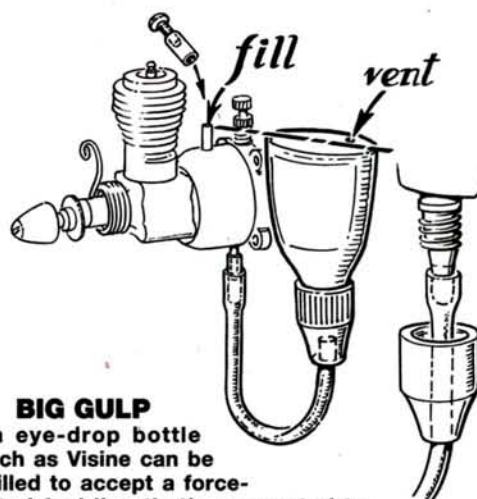


## MANUAL TOW

A cheap carrying handle or an outhouse paper roll holder (a) was

modified to permit hand-towing of a 2-meter glider. Also shown is a pulley arrangement (b) that will not cause wear on the expensive Dacron towline. Hand-towing is popular in Europe, and the single pulley method effectively doubles the towing speed.

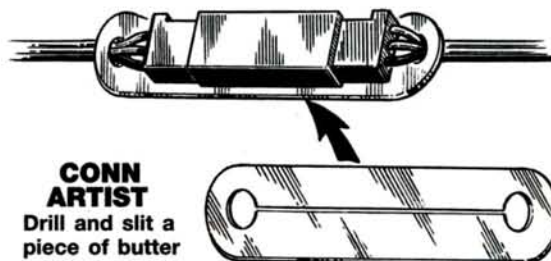
*Bruno Vantournhout, Opwijk, Belgium*



## BIG GULP

An eye-drop bottle such as Visine can be drilled to accept a force-fitted fuel line that's connected to your Cox 1/2A as shown. Pierce the bottle with a pin to vent it, then plug the line into the bottom overflow tube. Tightly cap the filler tube, using a screw and a piece of fuel line so that the engine will keep sucking fuel from the bottle even when the engine's tank is empty. Doubles the run time of your Cox.

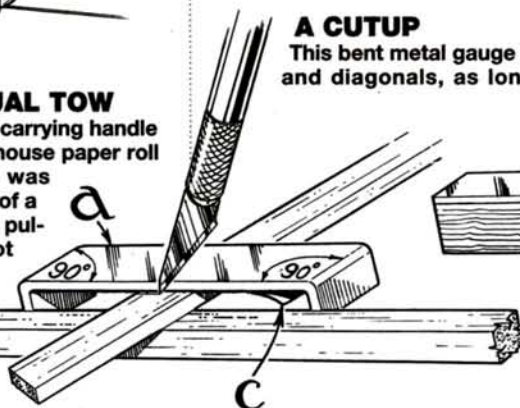
*Victor Singh, Bridgewater, Nova Scotia, Canada*



## CONN ARTIST

Drill and slit a piece of butter tub plastic, or similar, as shown. Force it over your aileron connector, etc., before plugging them together. Now you know they will not slip apart in flight. Ideal for hidden connectors that can not be easily inspected.

*Ray Brosinsky, Rocky Mountain House, Alberta, Canada*



## A CUTUP

This bent metal gauge (a) guarantees accurate cuts for spacers and diagonals, as long as the legs are in contact with the longeron, etc. When space is cramped, use the smaller version (b) with a hardwood block. Sandpaper (c) should be glued to the bottom to ensure that the tool does not slide.

*Bob Zimmerman, Des Moines, IA*



# Pilot **PROJECTS**

## A LOOK AT WHAT OUR READERS ARE DOING

### SEND IN YOUR SNAPSHOTS

*Model Airplane News* is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable. We receive so many photographs that we are unable to return them.

All photos used in this section will be eligible for a grand prize of \$500, to be awarded at the end of 1997. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: *Pilot Projects*, *Model Airplane News*, 100 East Ridge, Ridgetfield, CT 06877-4606.



### SOPWITH SCHNEIDER

Lawrence Klingberg of Canyon Lake, CA, spent 1½ years scratch-building this 1/3-scale model of a 1919 seaplane from Robert Hirsch 3-views. Made of balsa, spruce and plywood, the Schneider is covered in Solartex with Rustoleum paint and butyrate dope, and it features black MonoKote graphics. A Sachs 5.8 engine hauls the 50-pound plane through the sky.

### BEAUTIFUL BIPE

This model of a 1939 Waco ARE cabin biplane has an 88-inch wingspan and weighs 19 pounds. Buford Wilkes of Gas City, IN, scratch-built the plane and says that it flies very well on a Quadra 35. Buford's flying buddy Howard Martz took this photo.



### BASHED BEE

John Radebaugh of Seattle, WA, says that a Clancy Aviation Lazy Bee got him back into the sport after a 5-year hiatus. He bashed this 32-inch-span Bee by taking out a bit of its center wing section and positioning what was left over to mid-fuselage, then changing the decking a "wee bit." John tells us, "It flies like a scoot!" The Bee is powered by an O.S. 15.



### RECORD BREAKER

Mike Hawkins of Bangkok, Thailand, sent this photo of his 1/4-scale Davis D A9. The model has a 38½-inch wingspan and weighs 5 pounds, 4 ounces, with an Irvine 40 ABC engine. It features a retractable nose wheel and mechanical mixer for rudder/elevator. Mike first saw the full-size aircraft at the Lakeland, FL, EAA Sun 'n' Fun Fly-In.



### SUPERMARINE SPITFIRE

This 81-inch-span Dynaflyte Spitfire was built by Franco Giampiccolo of Beaumont, TX. It features Spring Air retracts and a 1/5-scale Officers and Gentlemen RAF WW II pilot. Franco covered the model to duplicate the camouflage and markings of the early RAF Polish squadron.





### AMPHIBIAN ON TAKEOFF

Charles Smith of Loveland, CO, scratch-built his Loening L-8 from Repla-Tech plans. It has a 70-inch wingspan, weighs 8 pounds and is covered with silk and dope. An Enya .60 gets this model off the ground and water.



### MICROJET II

Bradford Lewandowski of Toledo, OH, scratch-built his 1/2A Microjet II from *Model Airplane News* plans. A mechanical engineering student at Cornell University, Bradford built the entire airframe in one weekend and had the model ready for flight after another weekend's work. He says that it tracks perfectly straight and maneuvers very well.



### 1/6-SCALE HAWK

Rinie van Baardwijk of Drunen, the Netherlands, slightly enlarged *Model Airplane News* plans to build this 63-inch-span Curtiss P-6E Hawk. He covered the model with nylon/paper and dope and painted it in its authentic colors. The plane weighs about 9 pounds and is powered by a .90 Saito engine swinging a 15x6 Menz prop. Rinie tells us that he took the model to the field for the first time on his 33rd birthday, and he's pleased to report that it flew perfectly.



### WALLY'S ANTIQUE AEROPLANE

Wally Zober of Apopka, FL, scratch-designed and built this giant sport-scale 1911 Sommer monoplane. He powers the model with a G-38 engine and uses four heavy-duty Airtronics servos on rudder, elevator and ailerons and uses a standard servo on throttle. Wally uses a 6-channel Airtronics Vanguard system for control.

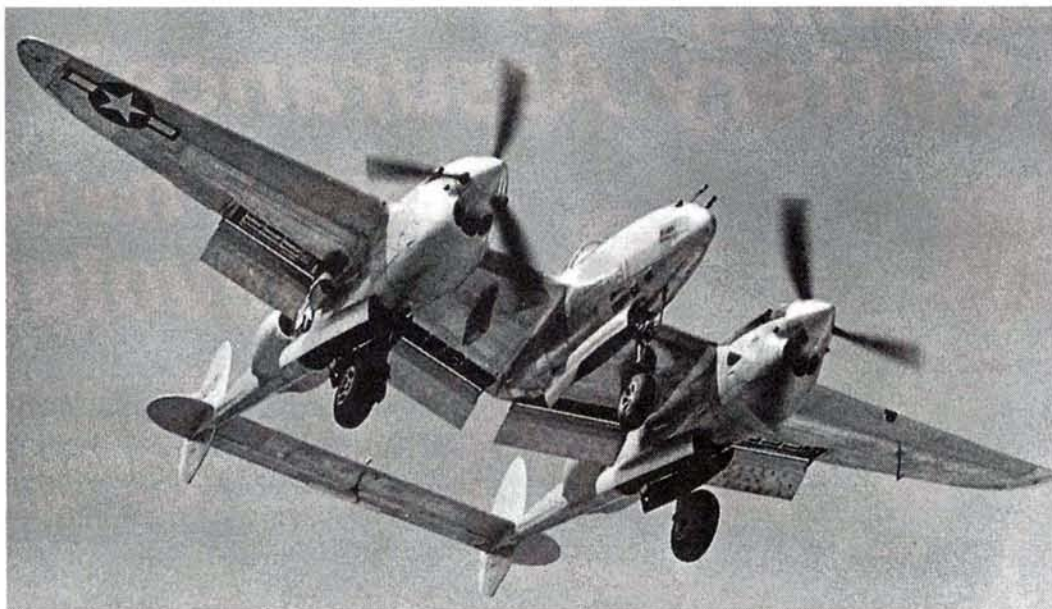


### STILL FLYIN' AFTER ALL THESE YEARS

Stan Rutz of Muskegon, MI, tells us that an ad in a 1938 issue of *Model Airplane News* offered a kit for this Comet Clipper for \$4.95; this model flew free-flight and control line and, after some cap-stripping and regluing, was resurrected 35 years later for R/C. An O.S. .20 4-stroke powers it now. Stan bought the Baby Bombshell in 1941 for \$1.50 and a year's subscription to *Air Trails*. The 14-ounce, 2-channel plane is still flying on a Cox Black Widow.



**I**N JULY '92 and June '93, *Model Airplane News* published articles on my pneumatically powered three- and two-position Fowler flaps. These articles contained photos, plans (FSP07922 and FSP06932) and construction notes for building and installing these flaps in a P-38 Lightning. Since that time, I have searched for ways to simplify and improve my designs. Of



*A good aerial photo of a full-size P-38 Lightning coming in for a landing. The full-size P-38 deployed 40 degrees of flap in the full-down position. In model use, Fowler flaps need only be deployed 25 degrees for the full-down position.*

# Servo-Operated Fowler Flaps

by BOB ALMES

*A simplified approach to  
3-position deployment*

particular significance is the development of a new flap hinge block that eliminated 16 items from the original parts list. When building four separate flap sections for a P-38, there are 64 fewer parts to build.

## SERVOS INSTEAD OF AIR

I have never been completely satisfied with the use of air to operate flaps. Air cylinders are heavy and require a substantial amount of onboard support equipment. During one of my experiments, I was pleased that I could program auxiliary channel servos to traverse a 130-degree arc. It became apparent that a 2 1/4-inch long servo arm could produce 4 inches of linear travel. At the outset, the idea of such a long servo arm was a bit disconcerting. However, one of the inherent features of Fowler flaps is that they require very little

power to operate. Unlike other flap designs, air loads are not directly applied to the actuating power source. In fact, air loads assist in the operation of Fowler flaps.

My friend Ed Newman is an avid scale enthusiast and a regular participant at Top Gun and the Scale Masters. Ed had acquired a set of *Model Airplane News* Fowler flap plans and contacted me about fitting the flaps into a 1/6-scale P-38. I told

him about my new servo-powered version, and 40 minutes later, he was at my door. We looked over the plans and discussed the various installation options. Ed brought up the possibility of using the servo arm to provide flap rotation as well as flap extension. I was intrigued with the idea and thought it worth further investigation. Ed is a draftsman by trade and offered to draw up the plans if I worked out the details.

The results are presented here.

Figure 1 represents my updated version of the original flap design. Telescoping tubes replace the original's air cylinders, a flap hinge block replaces the previous complex hinge assembly, and a servo replaces air as the power source. I used a set of these flaps in my 1/6-scale P-38 "Yippee" using JR\* 517 standard-size servos. The installation is lighter, less troublesome and eliminates the onboard air support equipment.



*Here's my P-38 model "Yippee" with the flaps fully deployed. The model lands like a butterfly with sore feet.*

PHOTO BY RICHARD HODGE



Figure 2 illustrates the concept of using the servo arm to create the flap-down angle as well as flap extension. The rotary motion of the servo arm is converted to linear motion by the pushrod connected to the flap hinge block. A second pushrod is connected to the flap control horn. The flap-down angle is created by a 1/4-inch difference in the linear travel of the two pushrods. This translates into a flap-down angle of 25 degrees using a 3/4-inch flap control horn. The servo arm design brings into perfect harmony the three motions involved.

## TUBULAR SUPPORT

I have experimented with various combinations of tubes to find the ideal material for friction-free operation. Brass and aluminum are not suitable for this application. The ideal combination proved to be Dave Brown Products\* fiberglass pushrods for the outer housing tubes and aligned fiber composites (AFC) 0.240-inch carbon-fiber tubes for the inner flap support tubes. If not available at your local hobby store, the AFC tubes may be obtained from CBA Models\* of Warren, OH.

Considering low-budget operation and the need for servo operation synchrony, I tested the JR 517 (40 oz.-in. torque) servo. During the tests, the 517 provided the desired linear travel; however, I had to sort through six additional servos before finding three that would traverse the same degree of arc as the first servo. Many low-cost servos do not maintain equal component tolerance levels, and this affects their ability to operate in complete synchrony. It appears that any standard, mini, or low-profile servo in the mid to upper price range will do the job. In some cases, wing thickness limits the size of the servo that can be used. I also tested the JR 321 (29.2 oz.-in. torque) miniservos in a 1/5-scale P-38 and encountered no problems in range of motion or power.

## CONSTRUCTION

Figure 2 illustrates the general layout of the parts for a Fowler flap. No specific dimensions are given because the various wing structures require a different installation treatment. The photos of Ed Newman's 1/6-scale P-38 show how the wing structure at the inboard flap position is different from that at the outboard flap position. Having determined how and where the parts would be placed in the wing structure, Ed made a jig to hold the tubes in proper alignment while he assembled the flap support tubes and flap hinge block. The tubes and hinge block assembly

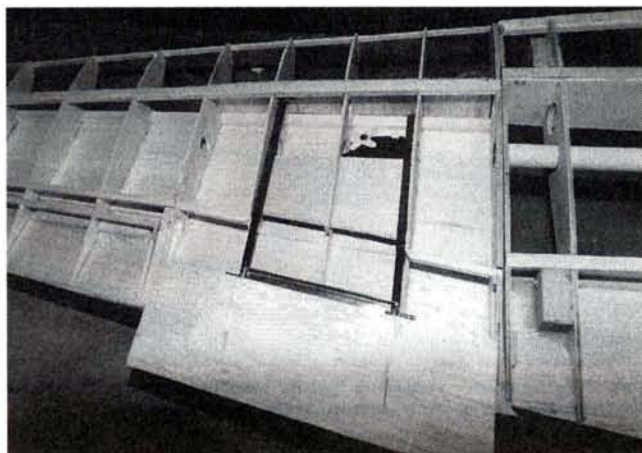
then became the jig, which aligned the outer housing tubes within the wing structure while they were cemented in place. Note that the tubes supporting the inner flap assembly are mounted on platforms spaced between the ribs. On the other hand, the tubes of the outboard flap assembly are mounted on balsa rails cemented to the rib structure. Ed plans to use the JR 321 miniservo to power his flaps.

The only part of the project that requires some degree of accuracy—the servo arm—is illustrated in Figure 3. Note that 3/32-inch ply is used for the servo arm, but fiberglass, carbon fiber, or plastic may be used for this purpose. If 3/32-inch ply is not readily available, laminate pieces of 1/32-inch and 1/16-inch ply together. Cut and shape the four servo arms, then sandwich all the parts together for the hole drilling operation. Any variation from the specifications cited in the drawing will at least be reflected in all servo torque arms. The shoulder around the splined hole of the servo wheel is not the same size for all brands. It may be necessary to chamfer the 3/8-inch-diameter hole to accommodate the servo wheel being used. After the 2-56 ball link and no. 2 button-head screws have been installed, snip off and grind down the excess lengths.

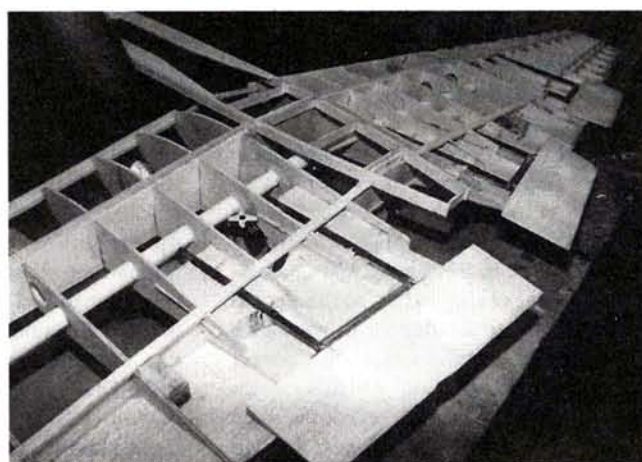
Figure 4 illustrates a method of constructing the flap hinge block. Another way would be to use hard balsa or basswood shaped to accommodate the trailing edge forward sweep and holes drilled for the tubes, hinges and flap pushrod connector. This would surely require a template to ensure proper alignment of the holes. Be creative.

## PROGRAMMING FLAP OPERATION

Select one of the flap assemblies as Flap 1. This flap will be used to program the servo travel endpoints. Flaps 2, 3 and 4 will later



*These two photos show Ed Newman's flap installation in his P-38. Note that the outboard flap installation (above) has the tubes attached to the wing ribs while the inboard flap assembly (below) has tubes supported by balsa platforms placed between the wing ribs.*



be mechanically adjusted to coincide with the operation of Flap 1. Remove the servo arm to be sure that it does not accidentally contact some part of the wing structure. A small, standard-length servo arm may be used to observe the operation.

Turn on the radio system, and enter the menu required to program the flap endpoints. Program the transmitter until the servo reaches its maximum flap-up travel. Reposition the small servo torque arm to assume the position as indicated in Figure 2. Program the servo's travel to the maximum flap-down position. Remove and reposition the servo arm as often as necessary until the flap-up and -down endpoints are the same distance from the half-flap position. The lengths of the servo arms for each scale size (1/5, 1/5.5 and 1/6 scale) are shown on the full-size plans and are designed to extract about 122 degrees of arc from the 130-degree maximum. This is to allow some room for adjustment at either end of the arc.

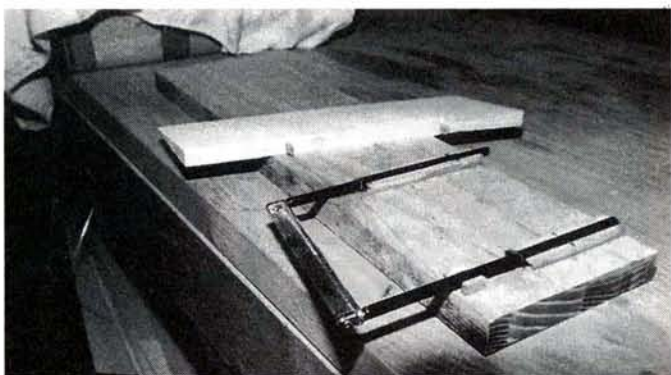
With the servo programmed to the maximum up endpoint, back it off about 4 degrees. Attach the modified servo arm to







## SERVO-OPERATED FOWLER FLAPS



This is Ed Newman's simple jig that he used to assemble and position the tubes before they were installed in the model's wing.

reflect the desired flap-up position, and connect the flap extension pushrod. Using a ruler for measurement, extend the flap to the required linear travel. The flap-up and flap-down endpoints have been established. Save these values in your computer radio and return the transmitter to the operate mode.

Adjust the pivot point of the flap hinge and the flap control horn pivot point so they are  $\frac{3}{4}$  inch apart. Connect and adjust the length of the flap angle pushrod so that the flap is set in the proper flap-up position. All things being equal, the flap should reflect a 25- to 27-degree down angle when the flap is fully extended. Connect flaps 2, 3 and 4 to the radio system. Position the servo arms to reflect the same flap-up posture as Flap 1. Adjust the flap extension pushrod to reflect the flap-up posture. Adjust the flap control horn to reflect the same  $\frac{3}{4}$  inch between pivot points as before. Connect and adjust the length of the flap-down angle pushrod to reflect the proper flap-up posture. The operation of all flaps should now coincide.

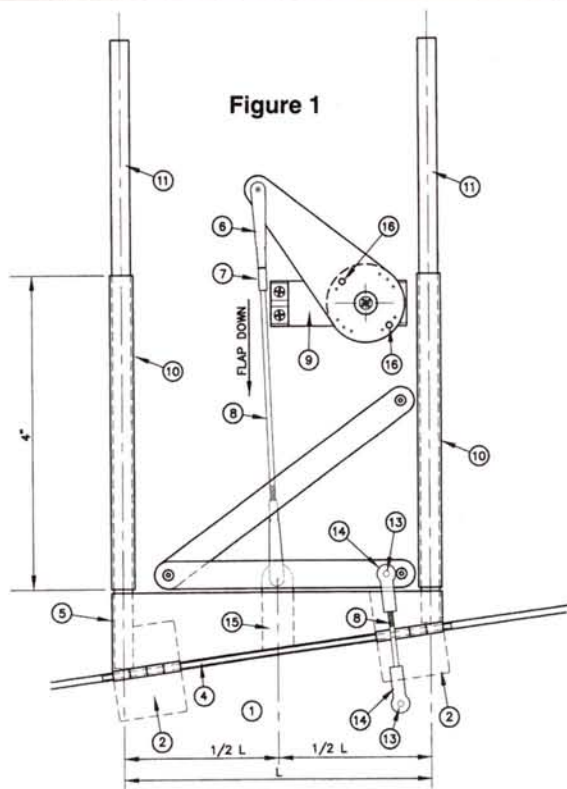
### RECEIVER HOOK-UP

As previously stated, Fowler flaps require very little power to operate. A double Y-connector system can be used to connect all four flaps to the receiver flap channel. This hook-up technique requires that all servos be installed so that the direction of travel is the same for all. If for any reason a flap or flaps should stall, the electrical load on a single channel may not bode well for the receiver. As a general rule, I never connect more than two servos to the same

receiver channel. To keep servo leads as short as possible, I use two receivers in my P-38s. All servos on the left-hand side of the aircraft are connected to the receiver in the left boom, and all servos on the right-hand side of the aircraft are connected to the receiver in the right boom. Of course, both receivers are on the same frequency and the antennas remain inside the booms.

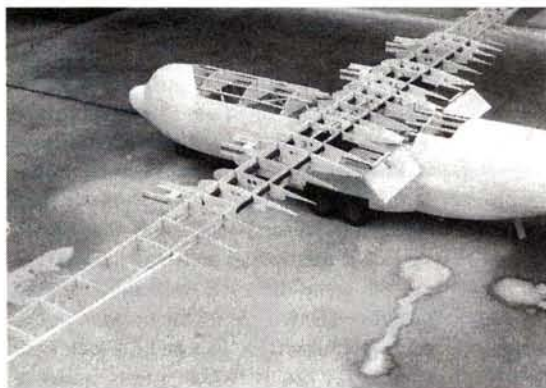
The two flaps per side can be connected to the receiver via a Y-connector or to separate channels that are mixed together. In the case where one receiver is used, it is recommended that the right-hand flaps be connected via a Y-connector to one auxil-

Figure 1



### Legend

- |                                    |  |
|------------------------------------|--|
| 1. Flap                            | 10. Dave Brown fiberglass pushrod            |
| 2. Kleet or Du-Bro hinge           | 11. AFC carbon tube 0.2400 in.               |
| 3. 4-40 self treading aileron horn | 12. $\frac{3}{8}$ 2 plywood servo torque arm |
| 4. 0.047 piano wire                | 13. Du-Bro 2-56 threaded ball link           |
| 5. Hinge block                     | 14. Du-Bro nylon socket                      |
| 6. Great Planes 2-56 clevis        | 15. $\frac{3}{8}$ 2 plywood tab              |
| 7. 2-56 threaded coupler           | 16. No. 2 button head sheet metal screw      |
| 8. 2-56 pushrod                    | 17. 4-40 x 1 in. bolt                        |
| 9. JR mini servo #321 or #3021     |  |



Joe Grable is scratch-building a C-130 Hercules and has included the P-38 flap design to fit his model. Originally, Joe had decided to use my older, pneumatic-powered flap assemblies but decided to wait for the servo-powered version. Joe's custom-built units are completely assembled to include the servo, prior to the installation, in the wing. When completed, the total flap area for this model will be 308 square inches. That is a substantial increase in wing area for landing.

iary channel and the left-hand flaps be connected via a Y-connector to a different auxiliary channel. The two channels are then mixed together. These latter two techniques offer an added advantage in that the direction of travel for the right-hand servos can be opposite that of the left-hand servos. Appropriate direction of servo travel can be controlled by the transmitter's reversing switches. This allows more freedom of servo installation for each side of the aircraft.

### FLIGHT OPERATIONS

I use a flap channel that is controlled by a programmable, three-position switch to provide flap-up, half-flap and full-flap deployment. I use 5-cell battery packs for the airborne equipment.

In my earlier articles, I cited a flap-down



Figure 2

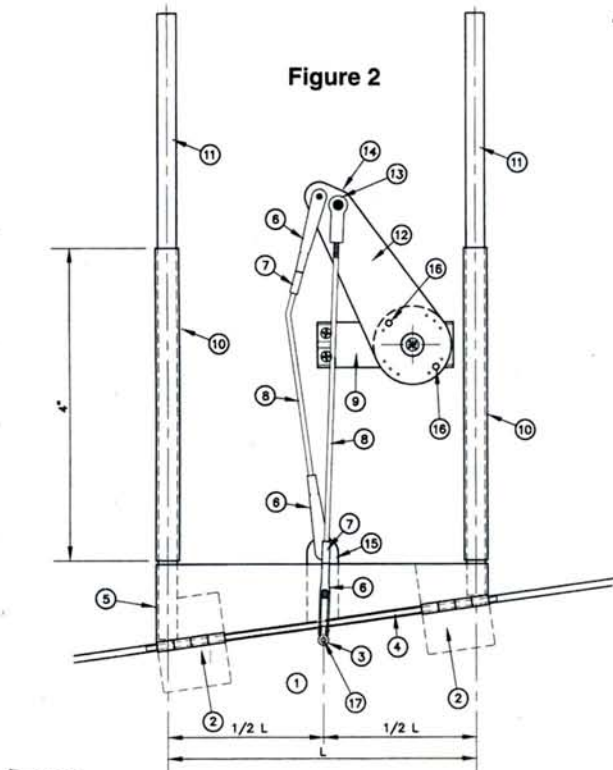


Figure 5A

Typical section through flap in down position

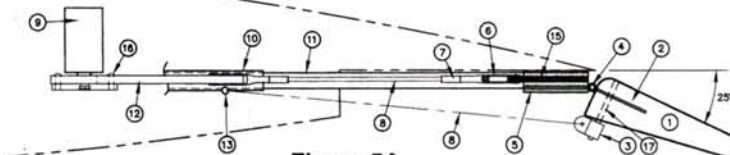


Figure 5B

Typical section through flap in up position

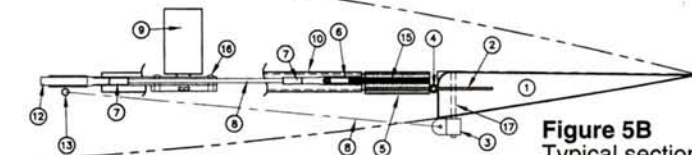


Figure 5B

Typical section through flap in up position

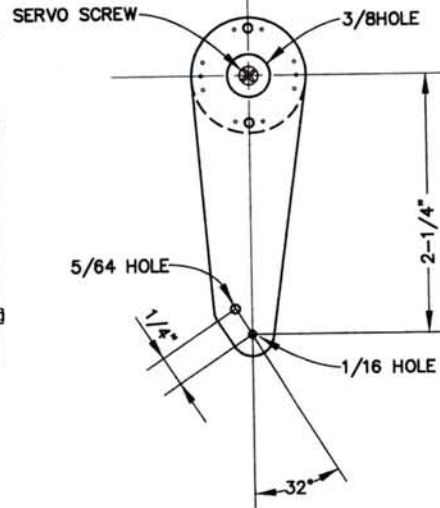


Figure 3  
1/5 scale  
pattern

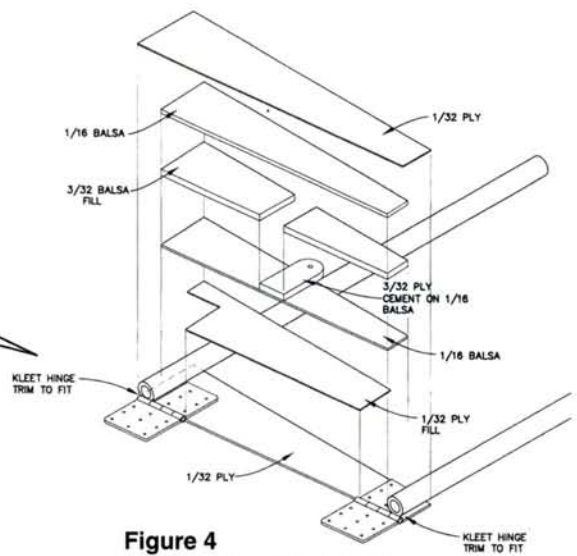


Figure 4

Hinge block construction

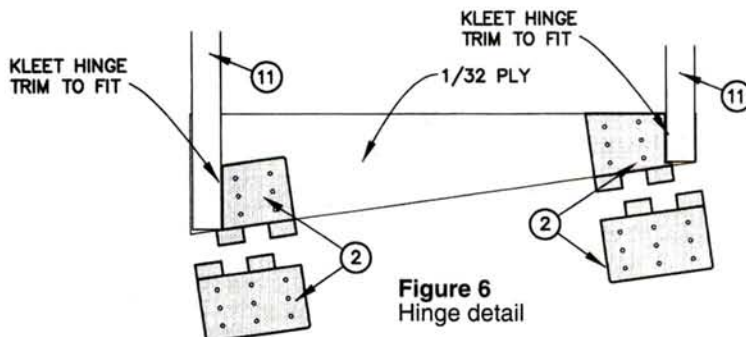


Figure 6

Hinge detail

angle of 40 degrees to be consistent with the flap-down angle employed on the real aircraft. However, speaking from personal experience, the model does not react to a 40-degree flap-down angle in the same manner as the real aircraft.

When the landing gear are extended, the

landing gear bay areas, as expected, create a significant amount of drag. A 20-degree, half-flap selection caused the model to balloon. On the final approach with a full 40 degrees of flaps deployed, substantial power was required to drag the model to the runway. This was completely unacceptable and

can be likened to driving with both brake and accelerator applied.

After all, we have scaled down the size of the aircraft, the flight control surfaces and the extension of the flaps. So why insist on maintaining a flap-down angle consistent with the real aircraft? Experimentation reveals that the ideal full-flap configuration should be about 25 degrees. Flight performance appears to closely approximate that of the real aircraft. Speed checks with a radar gun reveal the full-throttle speed in level flight is about 97mph. On final approach with flaps fully deployed, the speed is about 32mph. The 1/5-scale, 54-pound model touches down like a butterfly with sore feet.

\*Addresses are listed alphabetically in the Index of Manufacturers on page 123.





# Golden **AGE OF R/C**

by HAL deBOLT

## YOUR LETTERS

**T**HE PAST TWO editions have featured R/C pylon-racing history. The surprise was how extensive it is, and there's more! At this time, though, OT R/C needs attention, so we'll have a break from pylon racing to catch up a bit. Enjoy!

### FROM THE MAILBAG

A photo of OT'er Jim Kirkland with his Nats-winning, proportional-controlled Beachcomber in the June '96 issue prompted a fine letter from



**Colin McKinley's Astro 035-powered LW Yankee; only one of his extensive stable; advocates electric power for realistic OT R/C flights.**

Michael Garner of Ponte Vedra Beach, FL. He tells us the photo was taken at the '63 King Orange Internats and the trophy pictured was for that win. Mike mentions that as CD at the contest, he caught some flak about favoring a Florida flier. Of course, Jim's subsequent Nats win vindicated that judge's ruling. As a flier, designer and gentleman, Jim Kirkland was a "top gun"!

OT'er Frank Schwartz of Hendersonville, TN, has a passion for the designs of Harry Watson and the kits produced by Keystone Models in Lemoyne, PA, during the early '50s. Our recent discussion of the first "quick build" kits brought reaction from Frank reminding us of Keystone's Pacer kit. I believe I am aware of happenings of any magnitude in those days, but even with Frank's input, my knowledge of Keystone is very vague. After the LW Jenny was on the market, I do recall

being surprised by a small Keystone advertisement claiming that the kit could be built in four hours.

Apparently, Frank and friends had considerable success with the Pacer and found that it could be assembled in *less* than four hours. Wonder how? The fuselage had two plywood sides, just two ply bulkheads and a firewall. As with the LW Jenny, the Pacer's sides were fastened to the bulkheads with nail brads. Such simplicity required very little assembly time. The Jenny wing had a heavy-duty spar onto which notched ribs were positioned with robust, shaped and notched leading and trailing edges. The Pacer carried this one step further by eliminating the spar and substituting greatly oversize leading and trailing edges. Thus, either wing could be assembled in about an hour.

Frank is very anxious to have any information and/or material pertaining to Harry Watson and Keystone Models. His address is 102 Crestview Dr., Hendersonville, TN 37075.

Colin McKinley of Winston-Salem, NC, is a strong advocate of using electric power to duplicate the performance of OT R/C models. His stable of many so powered attests to his theory. The latest is an LW Yankee that uses an Astro 035 for power and has rudder-only control. It won the "Spirit of Selinsgrove" award at the '96 VR/CS meeting. (The Yankee was another encore to the LW Trainer, which attempted to entice more modelers into R/C by using a simple structure.)

Zach Allerton's friend Joe Broschart (Volant and New Castle, PA, respectively) scratch-built an LW Cruiser in 1965. He powered it with an Enya .29 and used Controaire reeds for guidance. After 250 successful flights that year, it was retired for



**Zach Allerton of Volant, PA, displays Joe Broschart's 30-year-old LW Cruiser and Controaire reed radio, which is now flying again. Note the pristine condition of this ancient model.**

more complex models. Now out of R/C, Joe took the Cruiser out of storage and gave it to Zach with the proviso that it would fly again. This past August, the 30-year-old model took to the air with a modern radio and an O.S. .26 engine for its 251st to 253rd flights without incident. Zach says that in spite of its age, it is a joy to fly!

Charles "Jerry" Burk of Arlington, TX, checked in with an interesting story. It seems that Chuck had an early start in R/C—1946, in fact. He purchased an R/C Headquarters system in kit form and sought the assistance of a ham operator for assembly. However, the RCH system never worked correctly and was not flown. Years later, with some experience under his belt, he dug the RCH system out and inspected it. Would you believe the ham operator had connected the signal switch to the tube's plate

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**Model Airplane News advertisement of 1957 offers the Keystone Pacer that could be built in just 4 hours.**



## AUTOGYROS—THE NEW FRONTIER?

If I may use an author's prerogative, I hope you will find this report interesting, even if not particularly OT.

When I spent over a year in 1977 investigating the mysteries of autogyro design, I found autogyros to be a neat, different and exciting way to fly, but general interest was not evident. Helicopters were the thing at that time. Since then, *Model Airplane News* published my Autogyro (September 1977), and there have been numerous reports of others enjoying that bird.



**Jim Baxter of Spokane, WA, has his twin rotor gyro performing well at a Phoenix gyro fly-in symposium.**

During the past year, I have been looking into more advanced autogyro concepts. With this effort, I was surprised to find I was not alone—better yet, there were numerous R/C'ers having a go at gyros.

It seems prudent for me to let you all know that there is an autogyro "movement" well under way. Gyro idiosyncrasies are not

mundane, and unfortunately, very little tech data is available in text form. Thus, the gyro people have found it expedient to band together to share their knowledge and experiences.

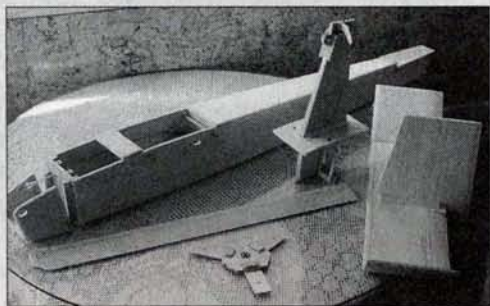
William Friedlander (Hudson, WI; email address: williamf@pressenter.com) has been serving as an unofficial clearing house for information both by mail and on the Internet. Bill indicates he has already had contact with over 100 modelers active and interested in autogyros. What seems apparent is that shared info has resulted in considerable gyro advances and performance increases.

In fact, the several autogyro symposiums and fly-ins held have had fine demonstrations of numerous styles of gyros in flight. Many have been outstanding!



**Lars Holmgren of Billinge, Sweden, is a gyro enthusiast; 10 years of development and successes plus a commercial rotor head.**

Most impressive was a demo at a Phoenix event put on by Emillo Cabezas of Spain (yes, the action is worldwide!). Imagine, if you will, that he holds the gyro in hand with the engine at full power, allows the breeze to bring the rotor up to speed, then simply allows it to fly out of his hand as you might hope it would! Then after showing the different autogyro flight abilities, he drops in nearly vertically to a no-roll-out landing. Remember, the only control used is "tilt-rotor." It



**Emillo Cabezas of Madrid, Spain, is an impressive gyro designer and flier. Note the simplicity of his current project.**

was most impressive to all and a fine demonstration of autogyro potential!

In this day of jets, turbines and helicopters, the modeling frontiers are disappearing. Thus the mystique of the autogyro can be appealing to those looking for newness. Best of all, gyros are not costly, as so many of the new tends to be. Interested? You, too, can get online!

[Editors' note: if you're online, check out the GyroNuts Web page dedicated to model autogyros at <http://ourworld.compuserve.com/homepages/noeth/>]

circuit. No wonder it didn't work!

Jerry got a real R/C start in 1952 with an LW Trainer and later with a deBolt Equalizer from *Model Airplane News* plans. His girlfriend (now his wife) painted the Jerry cartoon character on the Trainer for him. He tells us that he still has both 44 years later (with both looking a bit "frazzled"! ). Would bet that earns him a bunch of points!

About 30 years ago, Jerry switched to engine collecting and now has over 225 ignition engines. He recently returned to R/C and is amazed at what can now be had and done these days. Welcome back, Jerry!

Leo Martin of San Clemente, CA, tells us about the "hotrod" he has made out of the deBolt Special (a Goodyear prototype pylon racer). He has had four of the little racers, which were powered by .60s! As you might imagine, he says that vertical is right out of this world! Apparently, he and his friends enjoyed a raft of P-Shooters, but the acme was the Interceptor, which would do 16-point rolls on a line with only aileron input.

As an elder statesman, Leo, like many of us, finds aging eyesight a handicap for flying. He thinks that flying a larger plane might help, so he is now completing an LW P-51—hopefully, not .60 powered! A .40 was a great match for that one.

Richard Crawford of Iron River, MI, adds to the LW saga, saying that his Champion did well for him in 1961. Originally powered by a Fox .15, it used a Min-X radio with a compound escapement on rudder operating an S-N engine. After many flights, a Heath Kit propo system and a Veco .19 were substituted. Richard says he could really extend his flight times by leaving the landing gear off and hand-launching (which was the norm in those days, anyway). The propo really brought the Champ to another life! Rich now builds and flies fighter types but will always remember the joy of that first model.

So many of the incidents and experiences you all keep reporting involve my designs. I sure feel meek mentioning them time and again, but if that is the history, it leaves me with little choice—sorry! Maybe you could add some variety!

And so it was as you all climbed the ladder. Please don't forget that this is your OT R/C place!



by VIC OLIVETT

**W**HEN IT FIRST came out in 1986, many full-size aviation enthusiasts thought Jesse Anglin's Spacewalker captured the very spirit of Golden Age aviation. This experimental, homebuilt aircraft, with its open cockpit, steel tube construction and cloth covering, looks like it flew right through a time warp that originated in the 1930s or '40s.

Thanks to the giant-scale kits produced by Sig Mfg.\*, the Spacewalker has also captured the hearts of many modelers. With its gentle, yet aerobatic flight performance, the Spacewalker is becoming very popular at scale contests and is seen more and more at local flying fields around the country. But what was really needed was a smaller, ARF version. Kyosho's\* new Spacewalker ARF fits the bill nicely.



PHOTOS BY WALTER SIOLE & GERRY YARBUSH

K Y O S H O

ARF

# Spacewalker



should trial-fit the ailerons to check for clearance and smooth operation before securing the hinges in place with thin Zap\*. The plastic wingtips can be attached with a very thin bead of medium Zap, but don't use Zip Kicker; this will generate too much heat and distort the plastic.

I joined the wing halves with 30-minute Z-Poxy. The wing joiner

## CONSTRUCTION

The Kyosho Spacewalker is an all-wood sport-scale ARF model of the full-size counterpart, and it comes already covered with film in the Anglin color scheme. Wheel pants, plastic cowl and formed plastic wingtips greatly enhance the model's appearance. Assembly is easy, and the model can be put together in a couple of short evenings. Here's what I found when I built mine.

The wing is the first part to be built, and it comes as two wing panels. The Spacewalker uses two servos (one in each panel) to operate the barn-door ailerons. The hinge slots are already cut, but you



Golden Age spirit from a



fits well into the slots in each wing panel. After you join the two wing panels, you should remove the excess epoxy that squeezes out onto the outer wing surface with alcohol, then hold the panels firmly together with masking tape until the epoxy cures.

The aileron servo bays are already installed, and all you have to do is remove the covering over them with a hobby knife. Cut just inside the servo-bay openings so you can re-seal the covering. Each of the wooden servo covers has a slot that the servo output arm protrudes through. Remove the covering from over the slot and seal the covering around the opening with a hot awl. The servos are mounted on the covers for easy installation and service. I used Hitec® HS-422 servos. Mount the servos using the blocks supplied in the kit. Check the servo throw and adjust the slot openings if needed to allow free movement of the control linkage. I secured the extended aileron servo leads with shrink-wrap for added safety. Better safe than sorry.

## FUSELAGE

The pushrod exits at the rear of the fuse for the elevator and rudder are already cut out, but again, you have to remove the covering with a hobby knife. Make

## SPECIFICATIONS

**Model:** Spacewalker ARF

**Type:** sport scale

**Manufacturer:** Kyosho

**Wingspan:** 62.4 in.

**Wing area:** 666.5 sq. in.

**Weight:** 5.5 lb.

**Wing loading:** 19.04 oz./sq. ft.

**Airfoil:** NACA 2415 semisymmetrical

**Length:** 43.4 in.

**Engine req'd:** .32 to .40 2-stroke, .48 to .52 4-stroke

**Engine used:** O.S. FS .52S 4-stroke

**Prop used:** Kyosho 11x7

**No. of channels req'd:** 4 (throttle, elevator, rudder and ailerons) two servos for aileron

**List price:** \$349.99

**Features:** the Spacewalker is an all-wood ARF that is covered with film and includes complete instructions; a plastic cowl; wheel pants; plastic wingtips; formed-wire landing gear; wheels and hardware; and a clear windshield.

**Comments:** this is a good-looking, quick-to-build sport-scale model with excellent



flight characteristics.

### Hits

- Excellent low-speed performance.
- Good construction quality.
- Easy to assemble.

### Misses

- Position of the wheel pants makes takeoffs from grass a bit tricky. Installing the pants higher (exposing more wheel) would make for better ground handling.

sure you seal the covering around them to prevent fuel residue from getting under the film covering.

Temporarily install the horizontal stab and mark the center area of the stab where the covering is to be removed.

Being careful not to score the balsa, remove the covering from the stab. Then run a thin bead of medium Zap inside the fuselage slot and on the stab, then carefully slide the stab back into place.



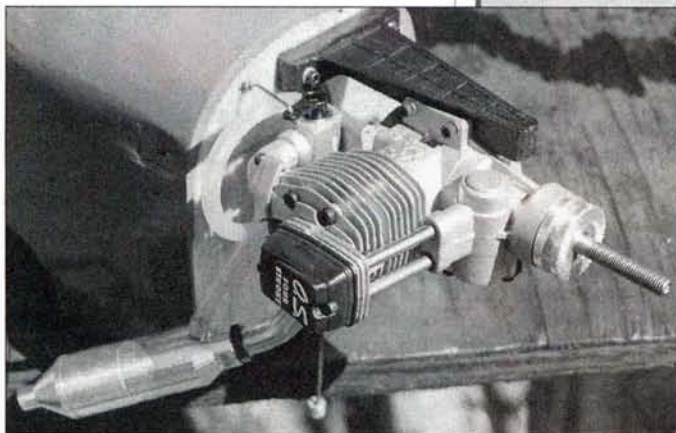
*modern classic*



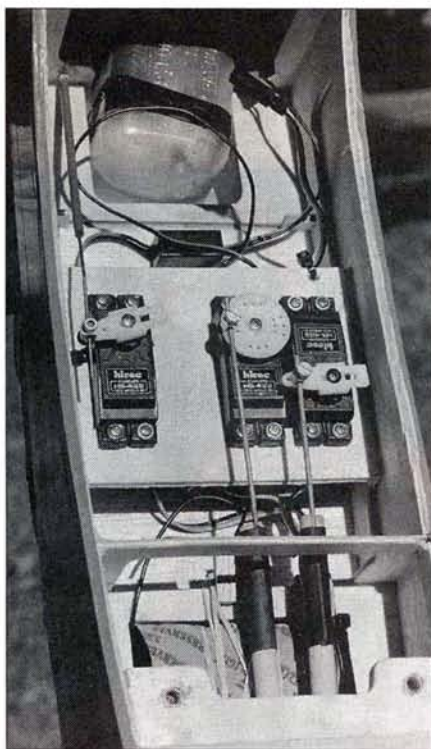
## SPACEWALKER ARF

Remove the spacer (it's not glued) from the vertical fin slot and trial-fit the fin into place and mark the glue line. Remove the fin covering below the glue line and install the fin. Wick some thin Zap in the joint and hold the fin in place until cured. Now, install the elevators, rudder and tailwheel, and then add the control horns as shown in the instructions. Nothing confusing here.

The landing-gear blocks come installed in the wing. Cut away the covering over the slot and clean out the groove at the



*I used an O.S. FS .52S 4-stroke engine to power the Spacewalker. The formed plastic engine mounts come with the kit.*



*There is plenty of room for any radio system. I used a Hitec Flash 5 with HS-422 servos.*

wing's center section. For a tight fit, I used some silicone rubber sealant in the groove before installing the landing gear. When Zapping the landing-gear cover in place,

The Kyosho Spacewalker powered by an O.S. FS .52S 4-stroke turning an 11x7 prop is a great combination. Because the engine is brand new, the first couple of flights ended in dead-stick landings. After a bit of engine break-in, however, and using Byron\* 10-percent sport fuel, engine idle and transition just keeps getting better.

### • Takeoff and landing

Apply throttle gradually and hold a bit of right rudder to keep the model running straight down the runway. Because of the scale wheel pants and relatively small wheels, takeoffs from all but manicured grass runways were a bit difficult and the model tends to get hung up and nose over. To prevent the model from nosing over, I found it necessary to use high-rate elevator to keep the tail planted during the initial part of the takeoff run. After about 75 feet, the model is ready to break ground and

only a small amount of up-elevator is needed to break the model free. Climb-out is with authority and very smooth.

During landings, the model has a very predictable descent rate and is very stable because of the large amount of dihedral. Once the model is in ground effect, you can pull way back on the elevator stick and slow the model down to a crawl without fear of a tip-stall. Flown from a well-kept grass field, I have made my best 3-point landings ever. Roll out is short, but again, if the grass is tall, the small wheels and pants tend to make the model nose over. If you fly from an average grass field, consider removing the pants altogether or at least raising them  $\frac{3}{4}$  inch to expose more of the wheel.

### • Low-speed performance

At just over  $\frac{1}{4}$  throttle, the Spacewalker is a nimble, easy-to-fly model. Coordinated aileron and rudder is a must, but the model loses very little altitude in low and slow turns. After takeoff, you can fly the entire flight at or below  $\frac{1}{3}$  throttle and do some very scale-like maneuvers. When it does happen, the stall is anticlimatic and requires that you release some of the elevator for the wing to start flying again. Add a little throttle, and you're heading back up to higher altitudes.

### • High-speed performance

At full-throttle and with a fair amount of down-elevator thrown in, the Spacewalker scoots right along, but I would not consider it to be a very fast model. Elevator/pitch sensitivity is increased, and low rate or about 50-percent exponential should be used for smooth flight performance. The model has no snap-roll or flutter tendencies, even when asked to do very unscale-like high-speed dives or pylon turns.

### • Aerobatics

The Spacewalker is very responsive to the controls, but not overly so. I found the best combination to be high rate on ailerons and low rate on the elevator. Loops are easily executed from level flight, but a small amount of right rudder is needed to keep the model tracking straight through the entire maneuver. The O.S. .52S gives plenty of power for vertical climbs, and the model does very attractive wingovers and hammerhead stalls if you feed in some down elevator as the model comes back down. Rolls with the ailerons at high rate are surprisingly crisp, and snap rolls are very quick for this type of model. Spins require high rate elevator to completely stall the wing before entry; otherwise, the model simply enters a fast spiral dive. Inverted flight is rather easy with some down-elevator added.

Overall, I found the Spacewalker to be a very pleasing model to fly with no bad habits. For someone stepping up from basic trainers, the Kyosho Spacewalker would be a very good low-wing advanced trainer as well as a good-looking semi-scale sport model.

be sure to remove the covering on the cover to provide a good gluing surface. Install the wheel pants and wheels using the hardware and brackets included.

This is a good time to fuelproof the tank compartment and the firewall. I use thinned epoxy applied with a disposable brush, then I install the engine, tank and throttle pushrod. Trim the cowl to fit the engine; an old hobby knife heated with a torch works well here. For good ventilation and to prevent engine overheating prob-

## FLIGHT PERFORMANCE

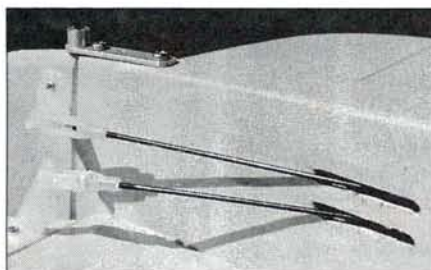


*The ailerons are controlled by independent servos (one in each panel) and have short, slop-free pushrods. The servos are mounted on wood access panels for easy access.*



lems, open up the front of the cowl in a couple of places. I also opened up a large area on the bottom of the cowl in front of the firewall to allow the hot air to exit. Check the fit of the spinner and prop and make sure to provide adequate clearance between the spinner backplate and the front of the cowl.

The Spacewalker just cried out for a good 4-stroke engine for power so I chose the new O.S.\* FS .52S turning an 11x7 Kyosho prop. I also used an aluminum Tru-Turn\* spinner to dress up the model's looks. After break in, this engine/prop combination performs nicely and provides more than enough power; most flights are flown at 1/2 to 1/3 throttle.



The tail linkage is typical and easy to install. The elevator halves are not connected and are controlled with a Y-end pushrod.

### FINAL ASSEMBLY

There's plenty of room for the radio installation, and my choice for the project was the new Hitec Flash 5 system. It comes with an 8-channel Supreme receiver, four HS-422 servos and a 650mAh battery pack. The Flash 5 has 2-model memory and three programmed mixes. You will also need two 12-inch servo extensions for the aileron servos, along with a Y-harness.

The center of gravity (CG) is located 3 inches aft of the wing's leading edge. The most effective way to balance your Spacewalker is to balance it inverted, with the fuel tank empty. Add weight to the tail or nose until the plane balances properly. The recommended control throws work well for starters. You can always change them later if your style of flying warrants it. I found that high rate on the ailerons and low rate on the elevator make for a smooth and very maneuverable model.

### FINAL THOUGHTS

I enjoyed both building and flying this sport-scale experimental, homebuilt classic. If you want a model with Golden Age spirit, and one that goes together quickly and has excellent flight performance, the new Kyosho Spacewalker ARF looks like a real winner.

\*Addresses are listed alphabetically in the Index of Manufacturers on page 123. ★

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7x3, 7x4, 7x5, 7x6	\$1.39
8x3, 8x4, 8x5, 8x6, 8x7	\$1.49

9x4, 9x5, 9x6, 9x7, 9x8, 9.5x6	\$1.69
10x4, 10x5, 10x6, 10x7, 10x8,	
10x9	\$1.99
11x4, 11x5, 11x6, 11x7, 11x7.5, 11x8,	
11x9, 11x10	\$2.19

## K Series



### black, glass-filled nylon

12x6, 12x8	\$2.89
13x6, 13x8	\$3.99

14x6, 14x8	\$5.59
15x8, 15x10	\$6.59
16x6, 16x8	\$7.59

## Classic Series



### black, glass-filled nylon

16x6, 16x8, 16x10	\$7.95
-------------------	--------

18x6, 18x8, 18x10	\$13.25
20x6, 20x8, 20x10	\$15.25

## Scimitar Series



### charcoal gray, glass-filled nylon

7x4, 7x5	\$1.49
8x4, 8x5, 8x6	\$1.59
9x5, 9x6, 9x7	\$1.79
10x5, 10x6, 10x7, 10x8	\$2.09

11x6, 11x7, 11x8	\$2.29
12x6, 12x8	\$2.99
13x6, 13x8, 13x10	\$4.29
14x8, 14x10	\$5.99

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### beechwood or maple

9x4, 9x5, 9x6, 9x8	\$2.10
10x5, 10x6, 10x7, 10x8	\$2.40
11x6, 11x7, 11x8, 11x10	\$2.70
12x6, 12x8, 12x9	\$3.45
13x6, 13x8, 13x10	\$4.20

14x6, 14x8, 14x10	\$5.55
16x6, 16x8, 16x10	\$9.50
18x6, 18x8, 18x10	\$15.00
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17th  
Annual

# KRC

## Electric Fun Fly

Something for everyone!

by LARRY MARSHALL



Don Bousquet's Curtiss NC-4, flying realistically above the crowd with Nate Bousquet at the controls.

**T**HE 17TH ANNUAL KRC Electric Fun Fly has come and gone. But to call this event a "fun fly" is like calling Woodstock a "concert" or WW II a "dispute." KRC is a "happening"! It's different because it's all electric, that's true. But the truly unique thing about KRC is that electric R/C'ers are still flying as a large happy group rather than splintering off into giant scale, jet, sailplane, scale, fun fly and other types of specialty events. At KRC they're all there, flying in the same air space, breathing in the same air and taking part in the constant pit chatter that is KRC.



Thayer Syme's 48-inch wingspan, 66-ounce Tiger Moth is powered by a geared AstroFlight 15 on 10 cells.



Dave Ribbe wowed us all with his fully aerobatic MiG 15. Dave powers the model with a 6T FAI40, 20 cells and a modified Violet fan.

PHOTOS BY LARRY MARSHALL





*Joe Beshar flew B-17s in WW II; this is a model of the last plane he flew. It weighs about 20 pounds and flies with four AstroFlight 05Gs and 32-SR1800s. He uses Zinger 12x8s to convert the torque and rpm to thrust.*



*Keith Shaw's amazing 81-inch wingspan, 15-pound Bearcat. It's powered by an AstroFlight FA160 and 32, 1700SCRCs spinning a 22x16 Zinger through a ModelAir-Tech 3:1 belt drive.*

In addition to the several hundred aircraft on the field, there are the vendors, rows of them. This year's "midway" must have been at least a football field in length, and still people packed the walkways like tuna in a feeding frenzy. All the tents along vendors' row and in the pit area added to the ambiance of this carnival. Of course, you could buy large pretzels, hot dogs, sausages and cokes, too. The only thing missing was the cotton candy. And no, I didn't forget them ... there were

plenty of clowns, this author being one of them.

Yes, KRC is Mecca for electric fliers. And they come ... on an annual pilgrimage to a small town in Pennsylvania ... holy ground. They come to fly airplanes; they come to be with friends they see but once a year. They come to stand in the presence of Shaw, Sribnick, Kopski, Aberle and others upon whose shoulders we mere mortal electric fliers stand.

*Charlie Evans brought his new Grumman Skyrocket. It's powered by a couple of geared AstroFlight 40s.*



*Tom Hunt's 1/5-scale Spitfire uses an Aveox 1412/2Y and 24 cells to power counter-rotating props via his ModelAir-Tech belt drive.*





# KRC



Left: a DeHavilland DM-91 Albatross from Laddie Mikulasko. This is a 6-foot wingspan, 5-pound plane that's powered by 10 cells and four Speed 400s. Right: Dave Grife's 1/4-scale Travel Air Mystery Ship. Power to fly this 18-pound, 87-inch wingspan plane comes from a geared AstroFlight 90, 36, 1700SCRC cells and 22x14 prop.

## Winners' Circle

Event	Place	Pilot	Airplane
Smallest Model	1st	Cecil Wethy	EMMS, 5-in. wingspan
Largest Model	1st	Jim Boxmeyer	Phoenix, 23-ft. wingspan
Best Multi-Wing	1st	Don Bousquet	Navy Curtiss NC-4
	2nd	Thayer Syme	DeHavilland Tiger Moth
	3rd	Keith Shaw	Black Baron
All Up/Last Down	1st	John McCullough	
	2nd	Karl Benson	
	3rd	Doug Holland	
	4th	Cliff Schaible	
Best Scale Model	1st	Dave Grife	Travel Air Mystery Ship
	2nd	Marc Thompson	Canadair CL-415
	3rd	Michael Stewart	Taylorcraft
Best Multi-Motor	1st	Dave Grife	DeHavilland Mosquito
	2nd	Keith Mey	B17F
	3rd	David Dantonio	XB260E
Best Technical Effort	1st	Rolf Schmidt	Flying Wing
Best Control Line	1st	Lester Froelich	
CD's Choice	1st	Keith Shaw	Goon
	2nd	Sam Stitzer	Sleep Walker
	3rd	Dennis Weatherly	Twin Dimwatt
Best Junior Modeler	1st	Nate Bousquet	Age 15
	2nd	Alex Assetto	Age 13
	3rd	Chris Mayir	Age 8

Many will tell you they come to learn. And learn they do. I attended my first KRC shortly after becoming interested in electric flight and I can tell you firsthand how much one can learn at the feet of KRC-goers. Ask a KRC guy, "How did you set up the motor system?" and you're likely to be treated to a trip through the innards of his aircraft ... all of them. That's how electric guys are, plain and simple.

A good example of the giving nature of these guys was Larry Sribnick of SR Batteries\*. Larry could have sold a lot of products during the KRC weekend. Instead, he and his ever smiling partner Steve Anthony set up and manned a "service station" where guys could go to repair planes, electrical equipment and/or get some SR hospitality. And so it goes at KRC.



An old-timer cruises slowly over the field.



Kirk Massey, owner of New Creations R/C, flew this Sterling Corsair using an MEC power system that demonstrated stellar performance.

## SO WHAT HAPPENED?

The big news this year was the new site. Parking limitations at the traditional location had become a problem in recent years, so this year, we were at the Queen Valley Airport in Allentown, PA. A nice chunk of paved runway was



**KRC** as an event was established some 17 years ago by a small group of electric fliers in the Keystone Radio Control Club. Since then, the annual event has grown from a situation where it drew three pilots external to the club to its current state that attracts hundreds of people from all over the continent (and many others wish they could attend!).

## 1996 KRC Club and Site

In large part, this is because the Keystone Radio Control Club is composed of an incredible bunch of guys who pour their heart and soul into making the event better each year. The interesting thing is that most of them aren't electric fliers. But they sure are nice guys.





Don Bousquet's "video plane" off on another run. Its 9.5-foot wing-span supports a video camera that points out the front of the aircraft.

at our disposal and there was *lots* of parking.

While the official flying start time is Saturday morning, KRC in recent years has actually "started" on Friday with a seminar series organized by SR Batteries. These continue to grow in popularity as more and more guys enter the electrics community and want to know more about the theory and pragmatics of flying electrics. In addition to this, SR hosted an indoor fly-in on Friday night for those wanting to enjoy the hum of small electric motors, the feel of rubber lube on their fingers and the graceful flight of an indoor free-flight model circling overhead. Besides, how often do you get a chance to fly models in a Hilton ballroom? Phil Smith was there, showing off his "photon control" aircraft, which turned in response to a beam of light being detected by an onboard photocell (see "Final Approach," January '96).

The R/C flying actually started on Friday as well, with the organizers opening the field late in the afternoon so pilots could set up their pit areas. But what's a pit area without airplanes flying in front of it?—and thus, that's what occurred. Good thing, too, as "wet" was on the horizon.

As is typical of KRC events, Saturday

morning found a bunch of fliers standing around in the dark, waiting for the sun to come up. Electrics fliers don't waste a minute of daylight. And so, from sunup to sundown the sky was full of aircraft. There were so many aircraft of note that I could go on and on about the airplanes, but I'll just mention a few of the notables.

The trend toward

large, high-powered electric aircraft continues. I think it's still the best-kept secret in our hobby, as most glow fliers have never seen one of these planes fly. Dave Grife was there with his air force. This year, Dave impressed us all with his 1/4-



Jim Ryan's Speed 400-powered Hellcat. Those are hand-painted markings, folks.

scale Travel Air Mystery Ship. Dave has done quite well with the plane, which is powered by a Cobalt 90 and 36 cells spinning a 22x14. He took first place in Scale. Another notable big boy was Keith Shaw's new Bearcat. While electrics are not noted for their sound, the sound produced by this plane just has to be heard to be believed. Several of us kidded Keith that he needed to amplify the natural sound, as it sure sounds like a Bearcat.

To anyone who thinks the term "electric jets" is a misnomer, I direct you to Dave Ribbe. Dave awed us by repeatedly flying solid aerobatics routines, including rolling circles, with his 6T AstroFlight 40-powered MiG 15. Fast and smooth is the best way to describe the plane and Dave's flying.



## KRC JUNIOR ACHIEVEMENT AWARD

Each year, the KRC organizers present a Junior Achievement award to a young pilot who has accomplished something significant. In '96, Nate Bousquet, age 15, was its recipient. Rumor has it he was given the award because of the way he has raised his father, Don, who is one of the nicest guys I've ever met.

But Nate is truly a deserving recipient of this award for his modeling/flying abilities. He's currently an honors student at Narragansett High School and quite a builder/flier of model airplanes. I first met Nate several years ago at KRC, where he was flying a plane bigger than he was. It had a camera in its nose, and Nate did a fine job of producing great flight videos of the meet. Of course, by then, he was an old hand (he was 10, I think) at flying, having soloed at age six. These days, he's still the youngest guy in the local club but performs a lot of the test-flight duties for other club members.

As an example of how well Nate has raised his father, his dad built the Navy Curtiss NC-4 Flying Boat that Nate's holding in the photo. It weighs 4 pounds and has a 62-inch wingspan. It's powered by four, 4.8V Speed 400 motors (16, 650mAh cells), and it flies well with those gorgeous, hand-carved props. Nate is the pilot, and when he flies it, you'd swear you were looking at the real thing. Rumor has it that someday he may let dad take a turn at the sticks.

Steve Neu showed us what "powerful" means by flying his F5B "sailplane." F5B planes are incredible machines that clearly defy the common view that you can have performance or duration from an electric airplane, but not both. Steve's demo flights showed us 150mph passes and vertical performance to die for (80mph straight up), and yet he managed to do quite well in the All Up, Last Down duration event as well.

One can't discuss an electrics event without mentioning the high proportion of multi-engine aircraft in evidence. C-130s,

This year's event director was Jim Wolstenholme. He, club president Antonio Assetto, John Hickey and a whole bunch of other very talented and dedicated guys worked especially hard, as the event was held at a new site, the Queen City Airport. The event also owes considerable thanks to the Airport Authority for their cooperation in the venture, as they provided us with superb facilities.

This year, this group played host to 224 registered pilots, around 300 aircraft and many onlookers. Not only were there a lot of U.S. fliers, but there was representation from Canada, Germany and Great Britain as well.



# KRC

B-17s, P-38s, as well as a bunch of sport twins carved up the sky all day Saturday.

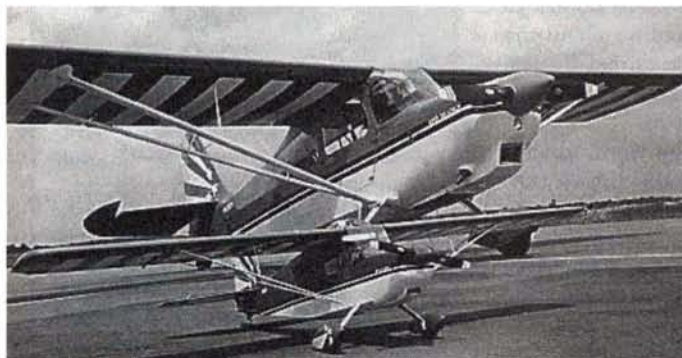
The Speed 400 "phenomenon" is now strong and growing in North America. What the Europeans have known for some

time is now becoming the mantra here as well. "Small is good!" Most G400 planes have wingspans of 30 inches or less and weigh 20 ounces or less. The Speed 400 motors themselves are inexpensive, as are the cells used to power them, so guys have found it fun to add their favorite war-bird to the air force

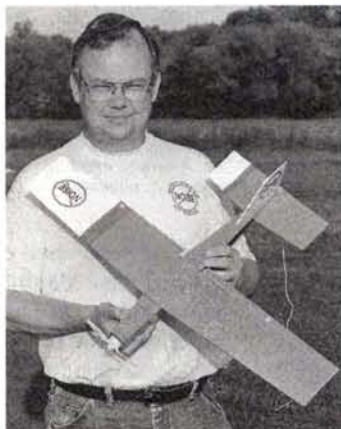
at a relatively small cost. Speed 400 pylon racers, sailplanes and sport planes abound. Jim Ryan and his compatriot John Kauk were flying their Speed 400 P-38 twins this year, and they certainly turned more than a few heads (see *Model Airplane News*, January 1996, for a construction article). Speed 400 sailplanes, generally with 60-inch wingspans, are also becoming very popular.

## THE RAIN CAME

Sunday, we weren't quite so lucky. It rained ... and it rained ... and it rained some more. At most meets, this would have resulted in packing up and heading home, but electric fliers are a bit more persistent. Many of us didn't show up quite so early at the flying field. Instead, we had a leisurely breakfast with fellow fliers, enjoyed



Left: while obviously not taken at KRC, this photo shows Clay Howe's Super Decathlon (converted from a Midwest Citabria kit) with the big brother on which it was modeled. Clay flew the plane at KRC, but this photo was much better than mine. Right: Tim McDonough now kits this fun-to-fly Speed 400 plane. It should be available through New Creations R/C.



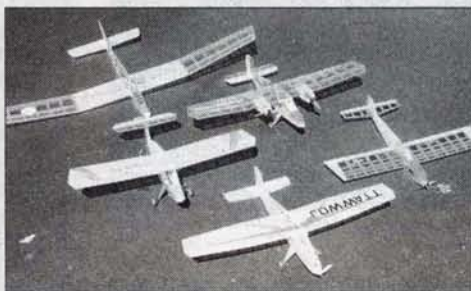
## KRC '96 VENDORS' ROW

by BILL GRIGGS

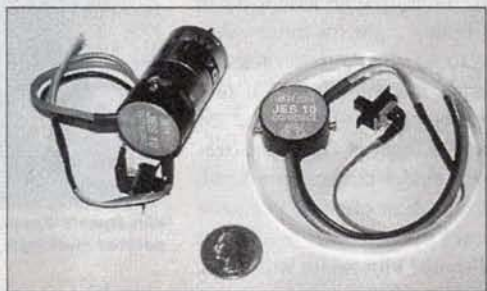
One of my favorite things about the KRC electric fly is that it is not just the world's greatest fun-fly but also a super place to shop. Every year, vendors of electric paraphernalia stock the back rows of KRC with their wares. You had better get there early, because some of the smaller vendors sell out the first day!

I always like to tour the vendors' area because there is always some new and innovative product that I wish I had thought of. It's also great to talk to the original designers of a plane. You can learn many tidbits, tips and tricks while having a good time chewing the fat.

There were a number of electric supply houses at the meet. It is no longer



Left: ModelAir-Tech has created quite a stir with its easy-to-build Stick series. These planes are built using only 1/8x1/4-inch stick wood. There are kits available for the Lowwatt (front) and Dimwatt (front right). Plans are available for the Soarwatt (rear), Twin Dimwatt (center rear) and the Bare Bones (far left). All models are powered by Speed 400 motors. Right: the new Jeti Jes10 Compact speed control bolts right on to the rear of a Speed 400 motor. The controller features a BEC and brake and will handle 10 amps continuously. It's available from Bill Griggs Models, Hobby Lobby and New Creations R/C.



John Chapis of Connie's Copies & Chapis Plans showed me his new Pollution-less Pig. The Pollution-less Pig is a vintage design from the '50s that has been updated for electric flight. John has many other plans available as well as several laser-cut kits.

difficult to get supplies for electrics; it is just hard choosing who to call each time. You could call CS Flight Systems\*, New Creations\*, The Institute of Silent Flight\*, Slegers Intl.\*, Hobby Lobby\*, SR Batteries, Penn Valley Hobbies\*, Aveox\*... the list just keeps growing. Sadly, I didn't get to see all the vendors at the '96 meet. I was busy at my own Bill Griggs Models\*, selling Speed 400 products. This gave me a new appreciation for those who do this every year. Many of the vendors never get to leave their booths to eat, let alone fly.

One company that is making great strides is ModelAir-Tech\*. Their "Stick Series" of kits and plans are very popular as they are fast building, inexpensive planes that really fly well and look great in the air. Don't think for a moment that these planes are all sedate and under-powered. Tom won the Speed 400 pylon race at the Nats with the Bare Bones. ModelAir-Tech also has several different belt drives to accommodate motors from 05 to 90 size. Tom even has a 1/6-scale Pica Spitfire with contra-rotating props!

Aveox has expanded its line to include electric kits and acces-





**The Spark is a new sailplane from Icare Models.**

each other's company and, of course, talked about modeling. Some flew that day, in spite of the rain. But the quick-thinking organizers pulled a rabbit out of a hat, got the airport authority to clear a hangar and then had the vendors set up inside. They rolled up the food wagons just outside, and we had a party—an electric modeler's party. We shared that



**Here, Doug Ingraham, the electronics wizard who's behind all those neat digital controllers and chargers from AstroFlight, holds his Graupner mini-Viper.**

hangar with a gorgeous full-scale Piper Cub and SNJ while sipping coffee, eating steak sandwiches and chattering endlessly about model airplanes. No rainstorm was going to get in the way of having fun at KRC!

So, if you have even the smallest interest in electric airplanes, or if you just want to have the time of your life at an R/C meet, mark the third weekend of September on your 1997 calendar, and meet me and some of the nicest guys on Earth in Pennsylvania next year.

*\*Addresses are listed alphabetically in the Index of Manufacturers on page 123.*



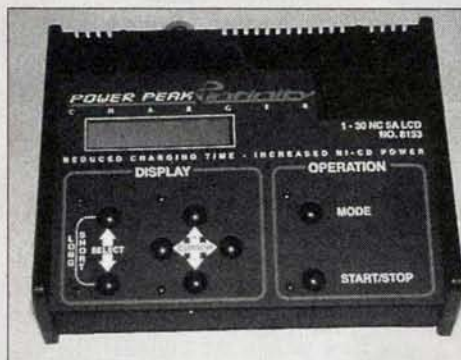
**MaxCim's Tom Cimato produces a line of brushless motors and accessories. Max 15 motors come in two configurations: Max 15 3Y wind motors deliver 1,470rpm per volt while the Max 15 3D delivers 2,570rpm per volt. By changing the number of batteries and prop, you can get power equivalent to an .05- to .40-size motor from one unit. Tom was flying a Telemaster 40 on 18 cells with a gearbox. The plane weighed 8 pounds and is a good example of what a gas flier would want to convert to electric.**

sories. Since Aveox began supplying Robbe with their own special Rovox-label brushless motors, Robbe has returned the favor and made certain products available to Aveox to market under the Aveox name. In my opinion, the best thing to come from this collaboration is the Aveox Infinity charger. This charger is awesome. It will peak charge from 1 to 30 cells, charge transmitters and receivers, cycle packs up to 99 times, record the last five charge values, walk the dog and brew the coffee! I am really hot on this charger! So I

bought one.

Hobby Lobby was there, and it was good to see Jim Martin's always smiling face. One of his compatriots was there flying one of their new Bella U-Es, which is a pre-built G400 sailplane. Jim, however, spent his time taking photos of all the guys he talks to via email.

There were really too many things to tell you about, so I will let the pictures do the talking for me.



**The Aveox Infinity charger is a my choice for product of the year. This charger will peak charge from 1 to 30 cells, cycle packs (charge/discharge) up to 99 times automatically and store data for the last five cycles.**

# Turn your great idea into cash.

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### PARTNERS FOR PROGRESS.

This new cash award program is funded by your **RADIO CONTROL HOBBY TRADE ASSOCIATION (RCHTA)** to help identify unique and revolutionary products/ideas which will benefit you and fellow R/C modelers nationwide. The contest is open to all individuals. A grand prize award of \$5,000 will be given for the best idea of the year, chosen from four periodic winners who will each receive a \$500 award.

The official kickoff of **PARTNERS FOR PROGRESS** will be made October 18th during the 1996 National Model and Hobby Show in Chicago. The first grand prize winner will receive his or her check for \$5,000 in person during the 1997 National Model and Hobby Show. Periodic and grand prize winners names will be published in R/C magazines.

Get peer recognition. Help others have more fun. And, just maybe, win a lot of money in the process.

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Address: RCHTA  
560 Bonner Road  
Wauconda, IL 60084



All products/ideas submitted will become part of public domain. See official entry form for complete details and rules of contest.





# RPM REAL PERFORMANCE MEASUREMENT

by DAVE GIERKE

## K&B .40 ABC

**K**&B\* has been producing quality engines for more than 50 years. Originally based in southern California, the operation was moved several years ago to Lake Havasu City, AZ. Along with the machines, tools, materials and inventory came the "brains" of the organization, Bill Wisniewski.

Wisniewski's contributions to model aviation have been many: he introduced the power-boosting tuned pipe, Schnuerle cylinder porting and the rear exhaust configuration, to name only three. In his younger days, Bill was a C/L speed champion, at one time or another hold-

the sensation of the competition.

One of Wisniewski's ground-breaking designs at K&B was the line of Torpedo Series 64 (1964)

engines. In their day, the .15R, .29R, .29F and .35 were among the most powerful production engines in the world. The new Goodyear R/C pylon racing event allowed a .40—a size

no one produced. Owner John Brodbeck Sr. directed Bill and fellow employee Jim Nightingale to develop the new engine. Using the Series 64 Torpedo .35 R/C as a guide, they produced the "Series 66" Torpedo .40 R/C, the granddaddy of the recently released .40 ABC R/C (no. 4050).

For the past 30 years, the Torpedo/K&B .40 (nos. 8011 and 4011) has been in continuous production using the highly successful Nightingale-designed low-tension Dykes-type piston ring. This unconventional ring has its top surface flush with the crown of the bar-stock aluminum piston and expands to seal against the chromed steel cylinder wall by the compression and combustion of the fuel. The lapped ABC (aluminum piston, chrome-plated brass cylinder) system represents a major departure from this time-honored method.

Another difference is the lack of a baffle on the ABC piston; it doesn't need one according to Wisniewski because, "Two control ports take the place of the baffle and save about 50 percent in fuel consumption." Historically, cross-flow (sometimes called open-loop) scavenged engines such as the K&B required a piston baffle. Cross-flow refers to the general direction of the gas flow within the cylinder (i.e., entering on one side, fresh air-fuel mixture flows toward the cylinder head after being deflected by the baffle). It is compressed, ignited and



K&B ABC R/C disassembled. Traditional K&B design and craftsmanship.

expands, pushing the piston toward bottom dead center. The piston uncovers the exhaust port, allowing spent gases to flush from the cylinder while minimizing mixing with the next cycle of incoming mixture. Cross-flow ported cylinders are easily identified: the exhaust is located directly opposite the transfer port.

Of course, modern Schnuerle porting schemes have proven to be more effective in limiting unwanted mixing than the older cross-flow method, except with Wisniewski's baffle-less piston cross-flow design, which allows him to continue using the old no. 8011 crankcase dies! (See the sidebar, "Control Port Technology," for a historical account of 2-stroke cycle control-port technology over the last quarter century.)

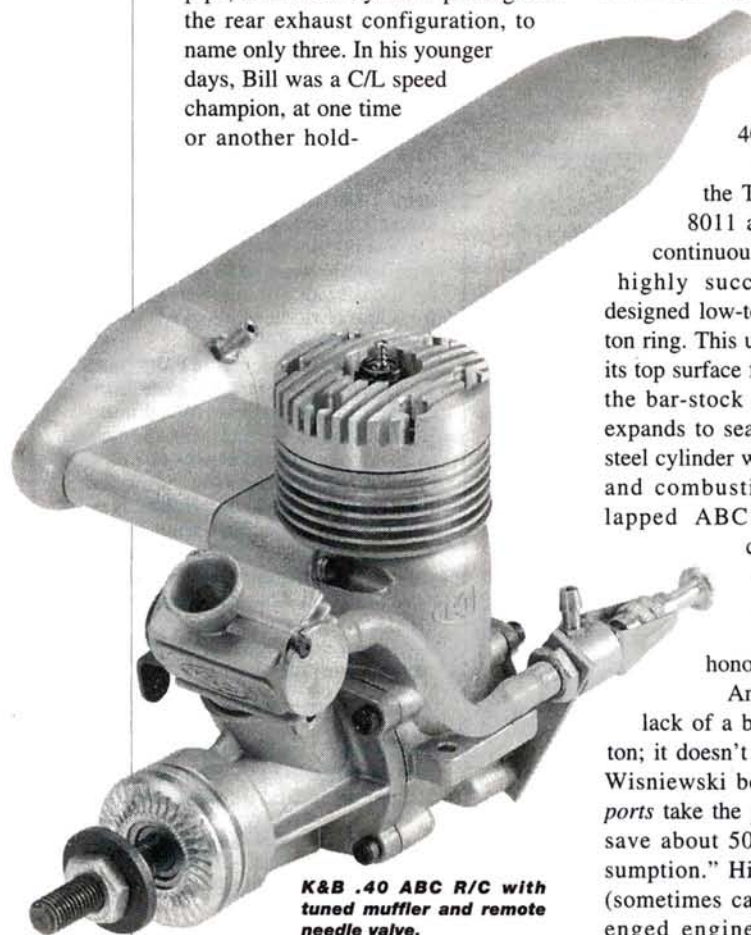
### WHAT'S IN THE BOX?

The K&B .40 ABC R/C engine comes with a no. 4035 tuned muffler, a general instruction sheet plus a carburetor and remote needle-valve illustration sheet.

- **Engine type.** Glow ignition, cross-flow scavenged multi-port design featuring an ABC piston and cylinder, dual ball bearings and front rotary valve induction.

- **Crankcase.** Made of die-cast aluminum alloy, the case is produced from the same dies K&B has used for the past 30 years. However, an additional bypass channel has been milled on either side of the main bypass to accommodate the two correction ports in the cylinder.

- **Cylinder sleeve.** Made of brass and chrome-plated, the two transfer ports



K&B .40 ABC R/C with tuned muffler and remote needle valve.

ing national records in all classes he chose to fly in. In 1966, Bill won the coveted world championship in FAI speed. His Schnuerle-ported, tuned-pipe, rear-exhaust *Pink Lady* model (all of Bill's models were painted pink) was







are highly angled toward the top of the sleeve. The large (0.750-inch-wide) exhaust has a centrally located bridge to prevent the piston from migrating from the confines of the cylinder bore. Wisniewski stated, "The same cylinder port tooling was used for this engine as was used for

the 7.5cc ducted-fan and marine engine, minus the control ports." Two small flow control ports are located on either side of the main transfer ports. They're aimed away from the exhaust and converge in front of the transfer ports but don't angle toward the top of the cylinder. The transfer

and control ports open simultaneously following a 10-degree (crankshaft rotation) exhaust lead.

• **Piston.** Cast from high-silicon-content (17 percent) aluminum alloy, the lapped piston features a flat-top (baffle-less)

## CONTROL PORT TECHNOLOGY

Part of the enjoyment associated with these wonderful engines is learning something about their development. If you flew "gas-powered" model airplanes in the 1950s, quit the hobby for 40 years, then became interested again, you would probably be impressed by the progress made during your absence.

The *engine designer* is most responsible for this advancement. Routinely dealing with subjects such as metallurgy, strength of materials, mechanisms and acoustics, the designer has to act with vision, analyzing, synthesizing, coordinating and directing how rapidly new materials, machines and processes are utilized in production. History provides numerous examples of failed designs produced by companies with excellent facilities and production personnel, while certain landmark designs were manufactured in garages and basements.

Don't misunderstand: in today's competitive market, it's a prerequisite to have up-to-date equipment. However, certain talented designers with a proven track record are actively sought by manufacturers for their services.

As technical knowledge doubles every 10 years, engine designers are pressed to keep up with the latest developments. Often, revisiting the past offers solutions for the future. Bill Wisniewski's latest cylinder



K&B .40 ABC cylinder (left) with laminar flow transfer ports and flow control port (arrow). The 1976 SuperTigre G.61 (right) with similar ports, including twin PDP slots (arrow).

der porting arrangement for the K&B .40 ABC provides an opportunity to follow the circuitous development path of design.

### THE PROBLEM

The single most difficult design problem concerning the 2-stroke cycle engine is *isolating* the cool, air-fuel mixture entering the cylinder through the transfer port(s) from the hot exhaust gases exiting the cylinder through the exhaust port(s). If separation could be achieved, torque, power, emissions control and efficiency in terms of fuel economy could be realized. For decades, designers have tried *almost everything* to solve the problem; some methods have achieved partial suc-



Notice the similarities between the K&B .40 ABC piston and cylinder (left) with the SuperTigre G.61 units (right). Lapped baffle-less aluminum-alloy pistons, chromed brass cylinders, highly inclined laminar flow transfer ports and flow-control ports.

cess. One of these methods is generally referred to as *control port technology*. Here's the story as I see it:

The December 1970 issue of the British *Aero Modeller* magazine featured a very informative engine modification article entitled, "SuperTigre" G.21-29 Grand Prix." One of the suggested improvements included the addition of "flow correctors." Author Magrotti explained their function: "Our motor uses cross-flow scavenging. The main fault with this system is that the inlet ports (transfers) are just in front of the exhaust ports, thus part of the fresh, incoming charge gets discharged with the previously burnt gases. To obviate this fault at least in part, it is necessary to add two 'flow correctors,' which are simply two narrow ports cut in the liner, facing away from the exhaust port, and without causing turbulence, nor mixing with the outgoing, burnt gases." (See Figures 1 through 4.)

Since 1960, SuperTigre had used a special patented variation of the cross-flow scavenging system. Known as *laminar flow* porting, it consisted of two very large parallelogram-shaped and upwardly inclined transfer ports opposite the exhaust, in conjunction with a flat-topped baffle-less piston. At the time, all other manufacturers were using a baffle to deflect the incoming mixture. I adapted the "Grand Prix" system in my Tigre G-40 ABC pylon racing engine for 1971. According to my notes, there was an improvement from 2.75 to 3.0b.hp on the dynamometer—a specific output of 7.5hp per cubic inch. The technique worked.



HB .40 cylinder with PDP control ports (arrow). The bridged transfer and exhaust ports are necessary to keep the compression ring within the confines of the cylinder. This engine also features a baffle top piston.



crown with three oil retention grooves machined into the top 0.150 inch of the head. The piston encounters an interference fit about 0.300 inch from the top of the sleeve flange and approximately 0.130 inch before top dead center (TDC). This agrees closely with modern thinking con-

cerning AAC/ABC technology. As described by Wisniewski, "Once the engine has been started, the sleeve will pull away from the piston, leaving the exact clearance necessary for maximum performance without seizing."

• **Wristpin and connecting rod.** The steel, hardened and ground wristpin is fitted with Teflon™ endcaps to protect against cylinder wall scoring, since the pin is free-floating within the wristpin bosses of the piston. The connecting rod is machined from bar-stock aluminum alloy having an

conventional baffled-piston, open-loop or cross-flow ported engines, but it is obvious that PDP works very well in conjunction with SuperTigre porting and a deflectorless piston" (*Model Airplane News*, January 1977, "SuperTigre G.61"). Chinn further explained the PDP system, "The PDP modification ... consists of a pair of narrow vertical slots supplementing the regular bypass (transfer-D.G.) ports and angled through the cylinder wall

to direct a flow of fresh gas across the top of the piston immediately in front (on the exhaust side-D.G.) of the piston" (*Model Airplane News*, October 1977, "K&B-Lee Custom .61").

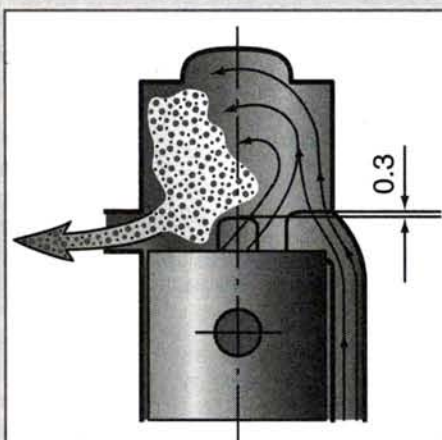
At this point, many of us who followed such developments were scratching our heads. Mr. Garofoli, the head of SuperTigre, had employed PDP control ports in his latest .61 for 1976 (see photo) and was rumored to have paid a royalty to Perry for every engine produced! If this rumor was correct, it's obvious that Garofoli didn't know the facts. First of all, Perry's patent only applied to engines with baffle-topped pistons (see patent drawing, Figure 5). Second, Perry wasn't granted his patent until 1981 after abandoning three earlier porting applications dating from 1975. Third, Magrotti's flow corrector disclosure in his magazine article probably placed the entire flat-topped piston application into the public domain, enabling anyone to use the idea freely. In fact, many SuperTigre racers had used the idea five years earlier!

The PDP system was also incorporated in the German HB (Helmuth Bernhardt) engines for 1976 (see photo) and Custom Lee K&B .40s and .61s (baffle piston) for many years. According to Clarence Lee, "John [Perry] originally developed PDP for

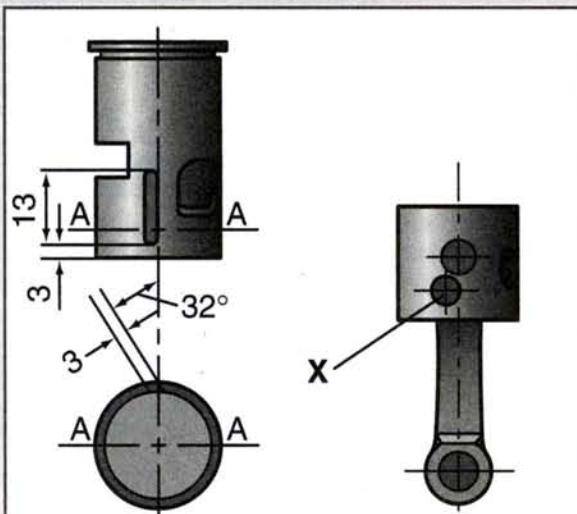
the K&B .61 in order to keep it competitive with Schnuerle scavenged engines. However, John Brodbeck, Sr. (K&B) didn't want to pay John licensing rights feeling the cost was too high

versus the power gain ...."

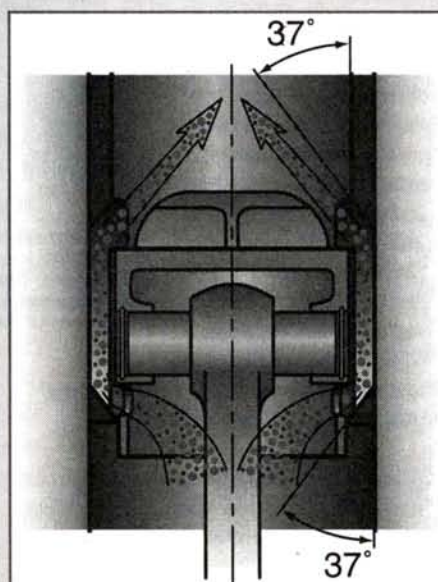
So, you ask, where does all of this lead? Right to the present—the recently released cross-flow scavenged K&B .40 ABC R/C uses transfer ports very similar to the old SuperTigre laminar flow design. The Tigre used a flat-topped, baffle-less piston—so does the K&B. Combine these features with Magrotti control ports (see photo), and what do you have? It seems that everything old is new again!



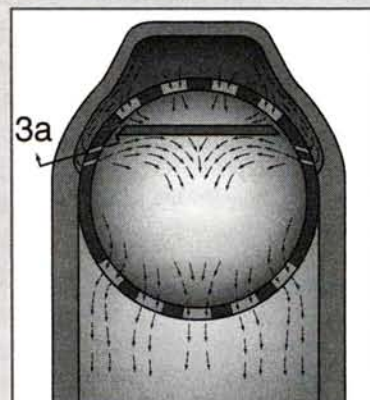
**Figure 1.** The addition of two "flow correctors" leaning toward the wall opposite to the exhaust compel the main flow to adhere to this wall so that the burnt gases do not mix with the fresh charge.



**Figure 2.** Cut the two "correctors," noting their direction. **Figure 3.** The fuel mixture passes through the holes (marked "x") in the piston to the "correctors" when the piston is at bottom dead center.



**Figure 4.** The flow of the "correctors" goes through the holes of the sleeve, entering through the cylinder when the piston opens the ports. The drawing shows the angle of the openings.



**Figure 5.** John Perry patent (PDP).



unusual circular cross-section for the majority of its length. The ends are machined in conventional manner with bronze bushings installed (press-fit) at both ends. The crankshaft end has two oiling holes.

• **Crankshaft.** The crankshaft features one-piece steel construction that has been case-hardened and ground to size for front and rear bearings (inner race) plus crankpin. In traditional K&B fashion, a steel propeller shaft stud (1/4-28) is threaded into the nose of the crank. A 0.350-inch-diameter passageway runs axially from the counterbalance end to the radially cut induction hole. K&B uses the popular *tapered split collet and drive washer* method of retaining the crankshaft in the front housing. The shaft is a light push-fit into the bearings, making disassembly simple. Things weren't always this easy! Early Torpedo .40s had the inner races of the ball bearings press-fit to the crankshaft, which made front housing disassembly difficult without the proper equipment. A very unique feature of the crankshaft is the shallow two-turn *spiral groove* that has been ground into the pressure seal area from the rear of the front bearing to the milled induction hole. This right-hand (as with a machine screw) spiral acts as a pump to any fuel that moves between the inside bore of the front housing and the crankshaft diameter. The system prevents leaks out the front bearing—a thorn in the side of all manufacturers of 2-stroke engines.

• **Front housing.** The pressure die-cast removable front housing retains two ball bearings to support the crankshaft. The bearings are also unique within the miniature engine manufacturing community because of their low-absorption nylon, 40-percent glass-filled ball retainers. Developed in-house by K&B 10 or 12 years

## SPECIFICATIONS

<b>Displacement</b>	0.40ci (6.44cc)
<b>Stroke</b>	0.720 in. (18.3mm)
<b>Bore</b>	0.840 in. (21.3mm)
<b>Stroke/bore</b>	0.857/1
<b>Engine height</b>	3.25 in.
—width	1.875 in.
—length	4.625 in.
<b>Tuned muffler length</b>	9.25 in.
<b>Width between mounting bearers</b>	1 21/64 in.
<b>Mounting hole width</b>	1 9/16 in.
—length	1 1/16 in.
<b>Weight</b>	15.4 oz. (440 gr.)
<b>Rpm range</b>	2,200 to 18,500
<b>Power output</b>	1.8hp @ 15,600
<b>Crankshaft thread size</b>	1/4-28
<b>Carburetor bore diameter</b>	0.310 in.
<b>List price</b>	\$155

**Features:** glow ignition, cross-flow scavenged multi-port design featuring an ABC piston and cylinder, dual ball bearings and front rotary valve induction.

**Comments:** this excellent American-made engine is the continuation of a legend! Its few cosmetic flaws have nothing to do with how this outstanding product performs, but in the highly competitive miniature engine market, the cover often sells the book!

### Hits

- Ease of operation.
- Remote needle valve.

### Misses

- Not-so-quiet tuned muffler.
- The 30-year-old crankcase dies need to be replaced. Roughness around muffler mount lugs, bypass and cylinder fins tells the story. Also, a few sharp burrs await unsuspecting fingers.

ago, these non-metallic retainers ended a recurring problem: engine blow-ups! These were traced to disintegrating metal retainers in standard production ball bearings. The rear bearing of the .40 ABC is a hefty 1.125 inches o.d. x 0.500 inch i.d. The front bearing measures 0.875 inch o.d. x 0.375 i.d. K&B continues to retain the carburetor with two setscrews located on opposite sides of the housing.

• **Cylinder head and backplate.** Machined of bar-stock aluminum alloy, the cylinder head provides generous surface area for cooling fins. The conventional squish-band combustion chamber is fitted for a long-reach K&B glow plug. Plug no. 7311 is recommended when using low-nitromethane sport fuels; HP plug no. 7300 for high-nitro performance fuels. The backplate is pressure die-cast of the same aluminum alloy as the crankcase. A centrally located boss is

provided in the backplate for a crankcase pressure fitting if high-pressure fuel delivery is desired for racing applications. Although not drilled or tapped, those wishing to make use of this accessory will have little difficulty completing the necessary tasks, providing they have access to the proper tools. Paper gaskets prevent air leaks at the backplate and the front housing.

• **Carburetor.** Designed with a bore diameter of 0.310 inch, the all-metal unit displays admirable idling qualities while still producing significant quantities of torque and horsepower. Besides the remotely located high-speed needle valve, the only other adjustment is the large mixture disk located on the carburetor's right side (as viewed from the front). A cam-action machine screw rotates the disk with micrometer precision to adjust the idle and mid-range mixture strength. Simple and effective! The throttle barrel doesn't have an adjustable stop. This requires that the servo set the limits for the high speed and idle—no problem with a modern radio.

• **Remote needle valve.** Located off the backplate—or any convenient place on the firewall, engine mount, etc.—it provides for a pleasantly uncluttered front of the fuselage plus a comfortable clearance between fingers and the spinning propeller. Besides, Wisniewski said, "Moving the needle valve from the carb body also cured some problems of the carburetor falling apart!"



**Spiral groove on crank surface acts as a pump to seal front housing to crank against leaks. The system works well!**

## OPERATION

After mounting the K&B .40 ABC to the test stand, it was outfitted with a relatively light load propeller for break-in (APC 10x5). The break-in fuel is the same we'll fly with, consisting of 15 percent nitromethane, 20 percent lubricant (half castor oil, half Klotz KL-200 synthetic) and 65 percent methanol. K&B suggests that you simply fly the engine *twice* with a slightly rich mixture setting for break-in. Those of you who are regular readers of this column know that I break in all engines on the bench; it's the safest way to learn their idiosyncrasies and protect your





Removable front housing with twin ball-bearing-supported crankshaft; 1/4-28 crankshaft stud and split tapered collet fasten aluminum drive washer to shaft.

investment. Generally, ABC engines such as this month's subject require less break-in time than other types, like those with ringed pistons and lapped steel/iron units.

About 30 minutes of total running time was required to hold a nice, peaked setting. This was accomplished by running the engine for 1 1/2-minute segments, then shutting it down to cool before restarting. The engine was always operated in the 2-cycling mode, slightly rich. Remember, ABC engines must be brought up to temperature quickly if they are to avoid premature piston-cylinder wear due to excessive zero-clearance rubbing (friction).

The shaft speeds obtained on a range of APC propellers after break-in:

9x7.5	.....14,000rpm
9.5x7	.....14,800rpm
9.5x8	.....14,300rpm
10x5	.....14,000rpm
9.5x8.5	.....13,600rpm
10x6	.....13,600rpm
10x7	.....10,800rpm
11x6	.....10,400rpm
10x9	.....9,700rpm
11x8	.....9,500rpm

The APC 10x6 propeller was selected as a reasonable starting point for a sport-type model. It was used in subsequent idle rpm and noise testing:

- Reliable idle rpm: 2,800
- dB @ 9 feet, 90 degrees from thrust line, muffler side of engine: 103
- Test conditions: temperature—70 degrees F; pressure—29.18 inches Hg; wet bulb—63 degrees F.

At the end of the break-in session, the engine was turning the 10x5 at a respectable 14,300rpm.

\*Addresses are listed alphabetically in the Index of Manufacturers on page 123.

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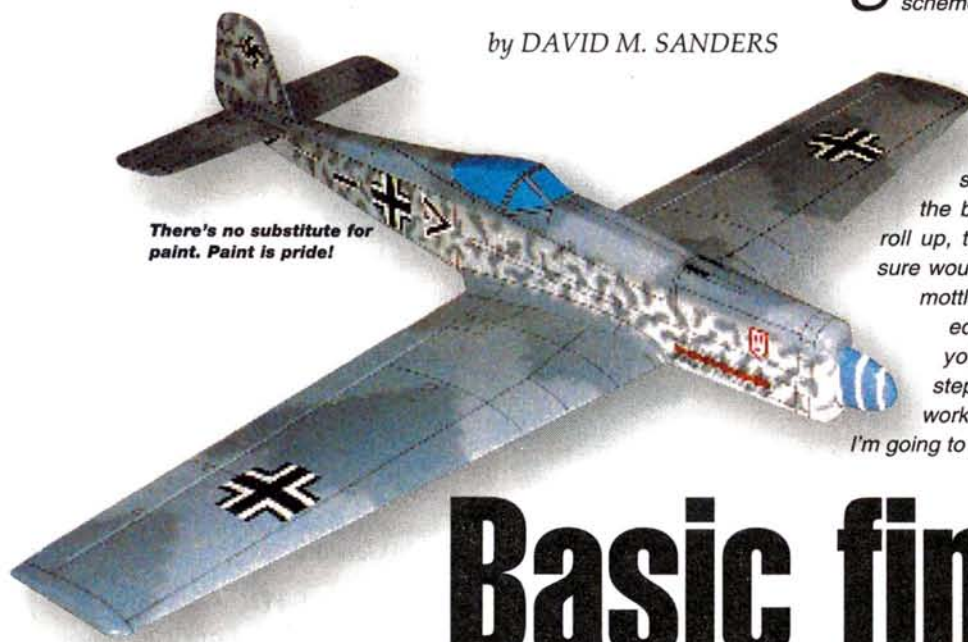


## Prepping and priming

by DAVID M. SANDERS

*There's no substitute for paint. Paint is pride!*

Sometimes, film covering just won't do for a color scheme you really want. Or in the case of scale planes, you just can't explain away how the builders of the full-scale prototype were able to get 8x30-foot pieces of MonoKote\*! That means it's gotta be paint. There's no substitute for paint. Paint is pride! When the boys at the field see a painted airplane roll up, they pay attention, don't they?! Man, it sure would be cool to be able to do that intricate, mottled camo on your warbird or the fade-out edge stripes on a sport model, eh? Well, if you break the process down into simple steps, you can easily create fantastic paint work on your planes with minimum fuss, and I'm going to show you how.



# Basic finishing techniques



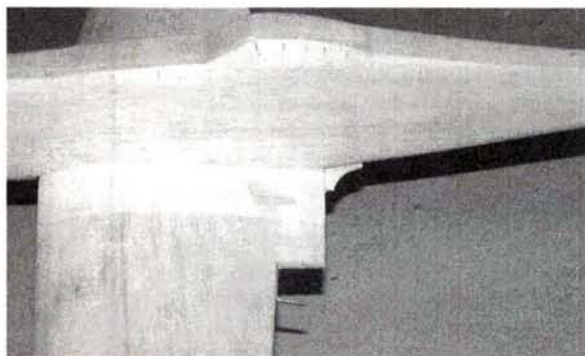
**1** Materials required to build a good fiberglass base for a paint finish. I prefer Pacer\* Z-poxy finishing resin.

### THE MODEL

The model I'll be finishing in this article is of fully sheeted construction, although fabric-covered aircraft with open-bay framing are also easily completed with

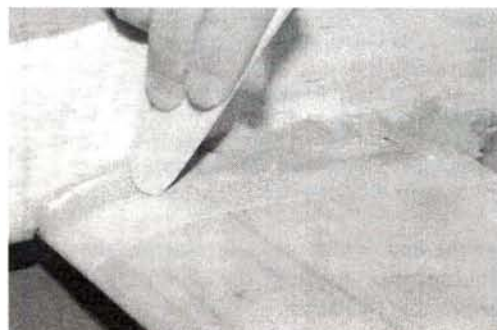
these methods. One major difference is that you must be certain to prep the fabric covering to accept paint per the fabric manufacturer's recommendations before proceeding. Also, you'll have to cut your masks before they're placed on the plane. This is a little more difficult, but not a huge inconvenience.

On wood-sheeted models, I always fiberglass the entire aircraft with at least 3/4-ounce cloth and epoxy or polyester resin. For a super-light finish, I cover with silkspan and dope. Either way, you'll want to have the wood completely covered with one of these materials to provide a smooth, stable surface for painting. In the case of fiberglass, I cut the glass to cover the part, lightly spray it with 3M Super 77, lay it over the part, smooth it out and



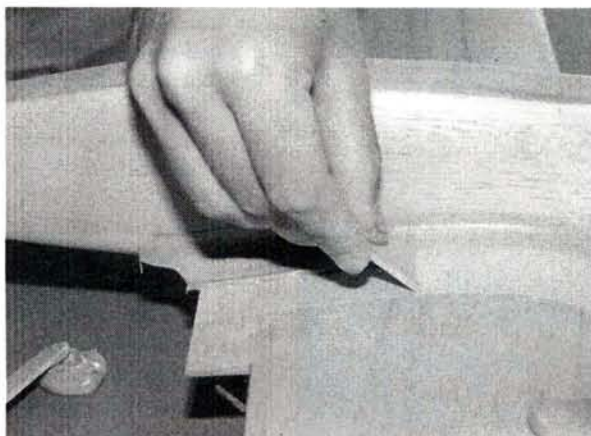
**2** Cover the wing with masking tape so the fillet doesn't stick to the wing. Make trailing edge fillet bases, being careful to get a good fit.

then apply the resin. I squeegee out excess resin with cardstock and get consistently lightweight glass jobs. Bob

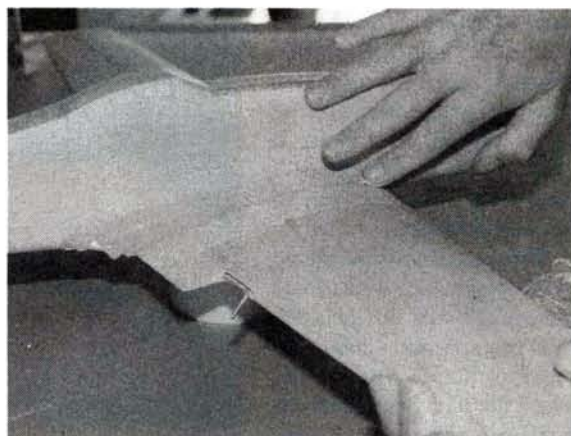


**3** After applying the filler material, use a circular-tipped tool to form the fillet.





**4** Scrape excess filler off the wing and fuselage sides outside the fillet line.



**5** After applying a second layer, use your finger to produce a smooth, true-to-form surface.

Fiorenze wrote an excellent article in the June '96 *Model Airplane News* on glassing that provides detailed descriptions of every step necessary to get a good glass job.

This article will assume you're starting with a plane that is built and covered by one of these methods and is constructed up through final assembly. The stuff I use for glassing is shown in photo 1.

## BONDO FILLETS

On this small Dave's Aircraft Works\* Focke-Wulf Ta152 slope glider, I wanted to have fillets at all the corners for a better scale look and in-flight performance. Good fillets can do a lot for your airplane's looks and performance, and since paint will easily follow any contour, I consider it a waste not to do the fillets on a plane I'm painting. On larger scale models, the wing fillets are usually part of the fuselage construction, but the Bondo method is still excellent for doing the tail surfaces, where applicable. *Don't* use spackle or model fillers, as they're way too soft and crumbly for this application. There are many automotive spot fillers available, so experiment a little. You're looking for stuff that is firm when cured and is easy to sand.

Wrap the wing roots with masking tape to make sure the filler won't stick to them, then mount the wing on the plane.

Next, you'll want to make fillet bases to fit the trailing edge/fuselage area (see photo 2). I use  $\frac{1}{32}$ - or  $\frac{1}{64}$ -inch ply for these. You want these pieces to have a very good fit against the fuselage and wing. Don't worry about getting the corner radius perfect yet; cut it oversize. You'll bring

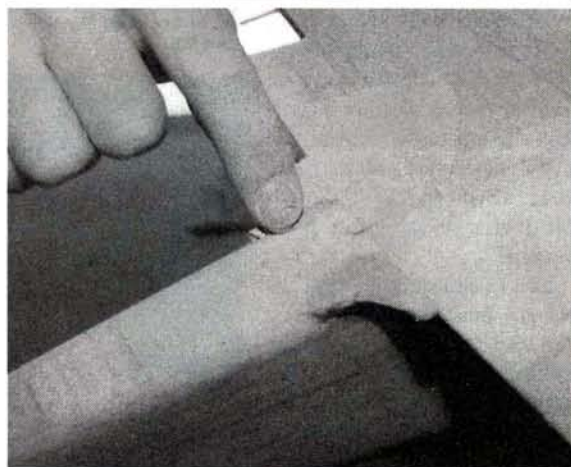
the trailing edges of the fillets down to the correct radius at the end of the process. Glue these pieces to the fuselage with thick CA or epoxy, and leave a  $\frac{1}{64}$ - to  $\frac{1}{32}$ -inch gap at the wing trailing edge.

You can support the fillet bases with a piece of masking tape on the bottom of the wing, too.

You'll need some sort of circular-tipped tool to form the fillets. A tongue depressor works great, as do Popsicle sticks for tighter radii. If you need an exact size, a piece of scrap balsa sheet can be quickly crafted into a suitable tool.

Mix up a generous batch of filler, then pack it into the corner so there are no bubbles or voids. Take particular care to get the filler into the tight corners at the fillet base, too. Only do one side of the wing at a time, and work quickly! The filler sets quickly, and it's a bear to form once it gets rubbery. Scrape out quite a bit of filler on the first batch, and don't worry about leaving too little behind (see photo 3). Scrape excess filler off the wing and fuselage sides outside the fillet line (see photo 4). You can also control the fillet width by rotating the tool as you pull it. Start at the front with the tool obliquely angled to the fuse side panel, then end with it perpendicular at the rear. This will yield a nice flared fillet. After the first pass sets up, mix another and repeat over the

**6** Apply filler where the fillet bases meet the fuselage.



**7** Use a suitably sized dowel, wrap a piece of sandpaper around it, and sand your fillets smooth.



**8** Carefully sand the correct radius into the trailing edge of the fillets.



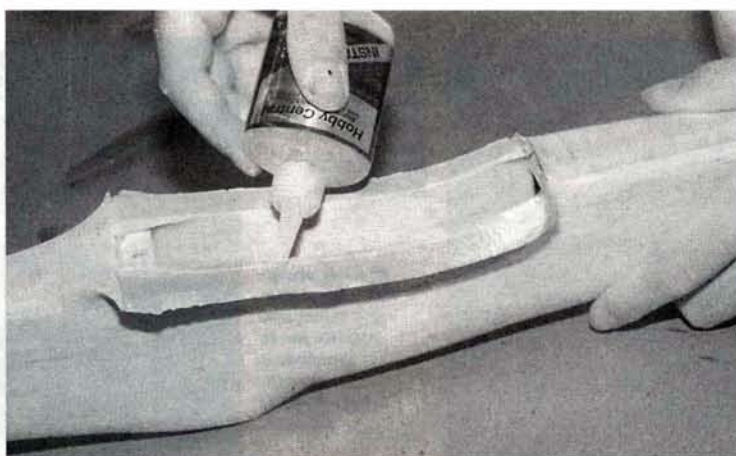


## BASIC FINISHING TECHNIQUES

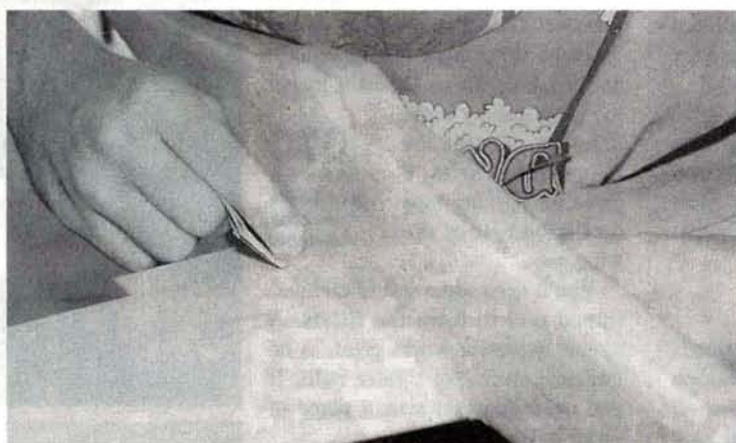
first layer. This time, pay attention to getting a smooth and true-to-form surface. I often use my fingers for this (see photo 5). At the wing leading edges, curl the fillet under to follow the wing. Sometimes, a third layer is appropriate, so use your judgment.

With both sides done on top of the plane, turn it over, and remove the tape that held the fillet bases in place during the previous steps. Apply filler where the fillet bases meet the fuselage (see photo 6). If your model has a belly scoop, e.g., P-51, form the bottom fillets, too. These usually have a smaller radius and are easier than the top fillets. Before the filler completely sets up, use your knife to cut through the fillet at the wing/fuse parting line.

You're almost to Nirvana ... but you must sand! Sanding is Zen and must never be taken lightly! That said, use a suitably sized dowel or piece of tubing, wrap the sandpaper around it, and sand your fillets smooth (see photo 7). The Bondo sands well and is stiff enough to allow continued fine-tuning at this point. Now carefully sand the correct radius into the trailing edge of the fillets (see photo 8), and smooth the transition to the top of the wing. As the shape gets close to being finished, start using fine-grit paper wrapped around your finger to really buff the Bondo smooth. Use more Bondo to fill any voids or pits at this stage, too. Carefully sand where the fillets meet the fuselage, and also try to get a consistent thickness over



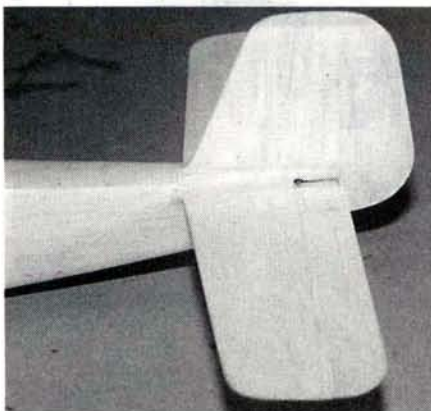
**9** With scrap glass cloth (1-ounce weight or less), cut some strips to lay over the wing-mating surface of the fillets, gluing it in place with thin CA.



**10** Once the edges are cleaned up, bolt the wing back on the fuse and fine-sand the fillets one last time.

the wing panels where the fillet edges will be sanded to their final width.

Now the work pays off! Unbolt the wing, and carefully lift the trailing edge out of the fuselage. The Bondo might stick to the tape, but have faith; it'll pop loose. The edges of the fillets will look raggedy, but resist the temptation to pick at 'em! Lay the fuselage on the bench, or place it in a stand, bottom up. With scrap glass cloth (1-ounce weight or less), cut some strips to lay over the wing-mating surface of the fillets. Spray these on one side with Super 77, then place them on the fillets, letting the edges run out past the outboard edge and into the fuselage cavity. Squirt the cloth with thin CA, and let it cure thoroughly (see photo 9). This makes the fillets very strong.



**11** Use the same techniques on the tail surfaces.

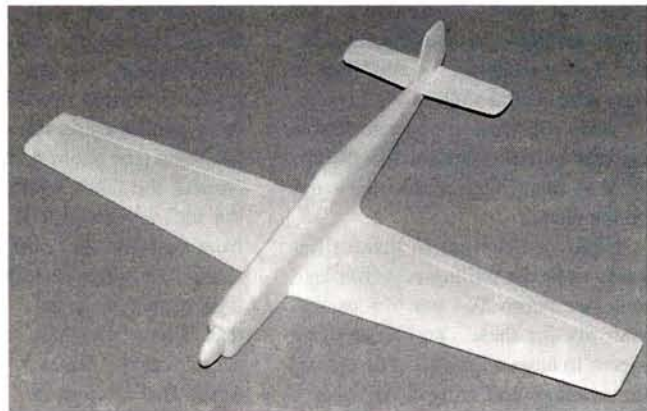
Trim the cloth flush to the fuselage cavity opening, and rough-cut the fillets' outboard edges with your knife or razor saw. Turn the fuselage back over, and mark the finish width on the fillets. Carefully sand the edges of the fillets to the lines with a *hard* sanding block. A piece of 3/4-inch particle-board sanding block works great. Once the edges are cleaned up, bolt the wing back on the fuse, and fine-sand the fillets one last time (see photo 10).

Now you have great-looking fillets on the wings. I use similar techniques at the tail (see photo 11), and it's actually much easier since these surfaces are usually permanently attached to the plane. Soon, you'll find you can make your all-wood aircraft have the shapely lines of much more expensive molded glass jobs.

## PRIMING

I get great satisfaction from seeing my model's shape in an all-white color with only its smooth surface contours evident. One of the reasons is that I get a chance to see any and all defects and correct them prior to shooting color.

Plasti-Kote sandable primer is an absolute must-have in my shop. This stuff is amazing and has saved my life as a model airplane painter after my previous



**12** The completion of priming is a milestone in your model's life. Enjoy it, because its shape will never be this perfect again!



favorite was reformulated and ruined! Don't substitute unless you're certain your primer sands well, as it can make or break your paint job.

Spray a generous coat of primer on your bird. Now sand it almost completely off with 220-grit aluminum-oxide open-coat paper. This fills the myriad tiny imperfections in your glass job and ensures that you haven't left any standing weave or seams. You'll immediately notice how smooth the surface feels after this step.

Spray a second coat, but not as heavy as the first. Sand with 220-grit until it gets "hazy" or semi-transparent.

Spray a light third coat that gives good coverage. Sand it lightly with 320- to 400-grit paper. This is the final primer coat and your last defense against the error-magnifying color coats to come, so inspect it carefully and prime again if necessary.

The completion of priming is a milestone in your model's life (see photo 12). Enjoy it, because its shape will never be this perfect again!

### WHAT NEXT?

Next time, I'll take you through masking, painting and panel lining. What we've accomplished so far has yielded you an aircraft that is completely paint ready, so start hitting the documentation, and see which flavor scheme you like best. Next month, we'll spill some paint on her!

\*Addresses are listed alphabetically in the Index of Manufacturers on page 123

### About the author

Dave Sanders has been an aeromodeler for over 20 years. He started off in his childhood years building Guillow and Comet scale free-flight models. He learned to fly R/C on power birds, but found his true love in slope soaring about five years ago.

An avid warbird fan, he founded Dave's Aircraft Works in 1994. He offers a line of small WW II fighter slope glider kits and a newer line of DAW Foamie warbird kits designed for slope combat and just flat insane sport flying thrills. He also writes "Fighting Foam & Heavy Iron"—a bimonthly column in the Radio Control Soaring Digest and acts as newsletter editor for the Laguna Niguel Slope Soaring Guild. He resides in San Clemente, CA, with his wife and photographer of eight years, Shelby, and his sons Ian and Trevor, who are also aviation buffs.

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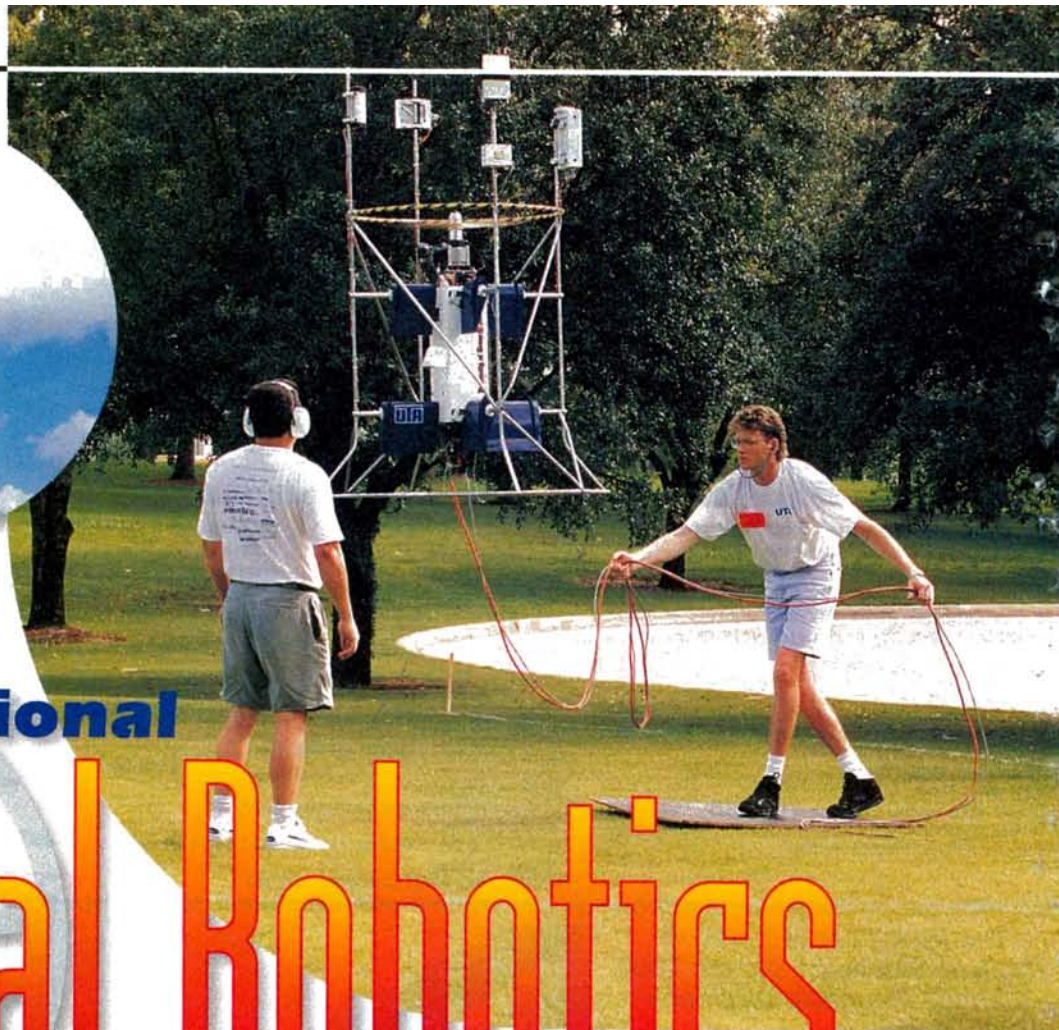
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University of Texas at Arlington Tail Sitter on the course.



University of Texas at Arlington Tail Sitter on a test hop.

# International Aerial Robotics Competition

by ROB MICHAELSON



Swiss Federal Institute of Technology entry is moved to the flightline.

University of Central Florida Hiller design about to be launched.



University of Texas at Arlington Tail Sitter is prepped for action.



**W**HAT AIR VEHICLE in the arsenal of any major world power can take off, fly itself to a remote location, search for objects on the ground, map and identify those objects from the air, swoop down and take samples from the objects, and then return home to land, all without human direction? Oh; let me also add that it costs under \$75,000 to build and operate.

"Well," you say, "it can't be the Viking lander because it didn't identify objects on the fly, nor did it bring any samples back home. Besides, it isn't really an air vehicle."

Give up? The answer is that there is nothing in any arsenal of any world power that can currently exhibit this behavior, but if you look around the world to see which university laboratories have their lights on at 3 a.m. and take a peek inside, you may see just such a machine.

## A window to the future



Swiss Federal Institute of Technology entry in flight.

## How The 1996 Winners Did It

• **BACKGROUND.** The winners of the 1996 competition were a team of students and advisors from MIT, Boston University and Draper Labs. Funding for the project was obtained largely from Draper and was applied over a two-year time frame.

• **AIR VEHICLE.** An off-the-shelf conventional TSK *Black Star* helicopter was modified to hold the sensor suite. This 15-pound helicopter was asked to carry almost 9 pounds of payload. A 35cc (2hp to 3hp) 2-cycle gas-line engine was used to power the robot.

• **CONTROL.** A 50MHz 486 microcomputer controlled the helicopter's servos through a modified radio-control receiver. As was common to most entries, the system was configured so that a human safety pilot could take control of the helicopter by flipping a switch on his transmitter, which would cause the receiver to follow the safety pilot's commanded servo positions rather than those of the onboard computer. This allows the safety pilot to save the robot should some failure be detected. The competition rules require that a kill switch also be available.

The receiver interface also exhibited a "fail-safe" capability. If the received RF signal doesn't meet certain criteria (indicating transmitter malfunction, out of range, or off), then control is automatically shifted to the onboard computer. Similarly, if the transmitter signal is bad and the commands from the onboard computer don't meet certain criteria (indicating computer malfunction),

then the servo actuators are commanded to a preset "fail-safe" position (all neutral).

• **NAVIGATION.** The navigation system used an extended Kalman filter that adjusts the weights placed on the various measurements (GPS, IMU, altimeter, compass) according to the situation. For instance, if the altimeter indicates a low altitude, it is given a higher weight than the GPS system's altitude measurement. Likewise, the GPS measurements are weighted according to satellite constellation and tracking mode; that is, if the GPS has differential lock, its measurements are given more weight than they are in single-point (non-differential) mode.

• **IMAGE PROCESSING.** Acoustic altimeters were used to detect the location of the toxic-waste drums as the robot flew over them (registering as a discontinuity in the otherwise flat ground), but an image recognition system was required to read the labels on the drums. An onboard video camera was also used by the robot to detect patterns on the ground below it. Images from the camera were transmitted to a Silicon Graphics workstation on the ground. Software analyzed the images for patterns of interest and reported their locations.



MIT helicopter on the course.

## WHAT WOULD WE SEE?

An international slate of collegiate teams worked independently for a year to develop flying robots that could perform the following mission: 1) find a dump containing partially buried drums of radioactive and bio-hazardous toxic-waste products; 2) map the location of each drum, identifying the contents by reading the drum labels; and 3) bring back a sample from one of the drums. The only hitch is that this had to be done, without any human intervention, by a flying robotic vehicle that could fit in the back of a pickup truck!

The task set before the student teams is a significant one, because location and remediation of toxic waste in industrialized nations is a major problem. Even with environmental laws that prescribe the correct handling of toxic waste materials, unethical companies often secretly dispose of their waste products in unapproved and dangerous ways. In addition, large amounts of toxic waste are known to have been disposed of improperly prior to environmental legislation. In either case, the location and composition of the waste is often unknown. Investigation of toxic waste sites is a dangerous job that is well-suited to unmanned systems.

Twenty student teams from universities in Canada, the United States and Europe took



## INTERNATIONAL AERIAL ROBOTICS COMPETITION

up this challenge during the 1996 International Aerial Robotics Competition. After a year of work, seven teams emerged as finalists and made it to the day of the competition (Table 1).

### A UNIQUE COMPETITION

The International Aerial Robotics Competition is now in its seventh year. In prior years, the challenge was to create an autonomous flying robot that could find a 3-inch-diameter metal spool, pick it up and move it to another specified location. After five years of increasing capability by teams from all over the world, a team from Stanford University produced a robot able to acquire a disk and transport it to another location without human intervention.

In 1996, the mission was modified to be less abstract, yet the behaviors to be demonstrated by the aerial robots remained the same: intelligent, stable, autonomous flight, perception of the environment and manipulation of objects on the ground from a flying platform.

### AN AERIAL ROBOTIC OLYMPICS

Because of the Atlanta Olympic Games, the traditional site—Georgia Institute of Technology—could not be used for the 1996 competition. However, since the new mission was one of great interest to the U.S. Department of Energy, that agency agreed to fund the relocation of the competition to

Walt Disney World's EPCOT Center near Orlando, FL, where it was to be showcased as an EPCOT technology attraction.

### DOWN TO THE WIRE

Two days before the competition, Stanford University—the acknowledged front-runner and winner of the 1995 event—

those vying for first place had widened.

The Swiss team took an early lead by placing first in the static judging, gathering the most points for subjective measures such as "elegance of design and craftsmanship," "innovation" and even "best team T-shirt." For this, they were able to choose the pole position during the performance



*Oakland University robot on the Robotics Competition field, with labeled barrels in place.*

announced that they had experienced an electronics hardware failure from which they could not recover in the time remaining. Not all were disappointed by this turn of events, since it meant that the field of

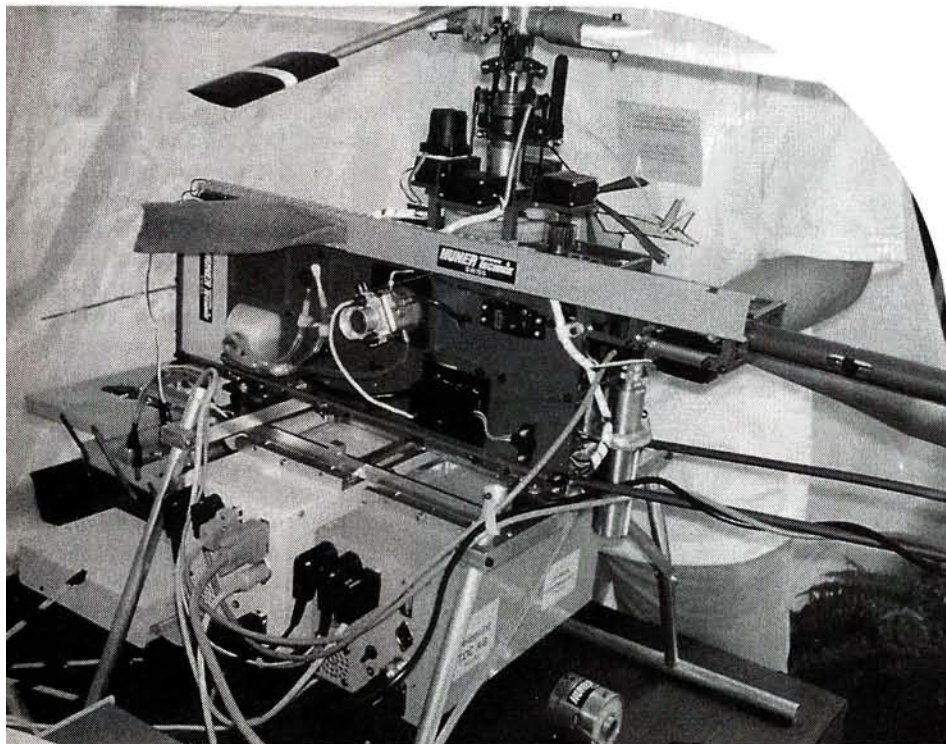
part of the competition to follow.

But it was the team from the Massachusetts Institute of Technology (joint with members from Boston University and Draper Labs) that won. The MIT aerial robot leapt into the air on its first run and proceeded to search for and locate each drum correctly with the aid of differential global positioning satellite (DGPS) fixes. It then went back and attempted to read the toxic-waste warning labels at the locations where it had previously identified drums to exist. No attempt was made to retrieve a sample.

The MIT aerial robot went on to demonstrate six fully autonomous reconnaissance flights during the team's hour-long time slot. During its best run it correctly located all five drums and correctly identified the contents of two of them to compile a score of 1,027 out of a possible 2,310 points.

### AERIAL ROBOT DESIGNS

Most of the teams decided to modify conventional hobby helicopters to lift up to 50 pounds in the high humidity and heat that would be encountered in Orlando. The MIT entry was a conventional helicopter with a single teetering rotor, flight computer, global-positioning system (GPS) and various sensors to measure altitude above the ground, heading, attitudes and





rates, as well as computer vision. The sensor suites onboard each of the competitors' aerial robots, though different in design, were similar in function.

The strategy of the MIT team was to fly a pattern over the toxic-waste dump and sense altitude changes caused by the presence of the partially buried toxic-waste drums. The GPS location for each anomalous altitude was stored for future reference as the aerial robot flew a pre-programmed search pattern. The aerial robot then returned to these locations to read the labels found on the sides of the drums. As with most teams, image-correlation algorithms could then decipher the meaning of the label, and hence, the contents of the drum.

In addition, those teams wishing to accrue extra points for retrieval of a sample implemented a grappling device that could be operated from the air vehicle while in flight to snatch the 3-inch-diameter, orange, metal disk that simulated the biohazardous sample. The location of this disk was unknown to the teams beforehand, as were the locations of the five toxic waste drums that were repositioned between runs to keep teams from having any *a priori* knowledge of the site (other than that the drums were black, randomly placed and may or may not be partially buried at arbitrary angles).

## VARIATIONS ON A THEME

Several of the teams came with unique air-vehicle entries, though that was the undoing of many other teams that originally made application to compete. Given a good flying platform, it is a significant task to make it fly intelligently and autonomously. Teams that add the burden of developing new flying machine concepts compound the difficulty of the task set before them. Even so, the millions of guests visiting EPCOT were treated to an interesting "Tail Sitter" design fielded by the University of Texas at Arlington and a really unusual twin-engine "Hiller design" from the University of Central Florida.

Teams have tried everything from blimps to rotor-assisted balloons (or maybe they were balloon-assisted rotors) to electric-propelled vehicles to the "heliquad,"

1. Auburn University	USA
2. Carleton University	Canada
3. Swiss Federal Institute of Technology (ETH) **	Switzerland
4. Georgia Institute of Technology **	USA
5. Georgia State University	USA
6. Massachusetts Institute of Technology **	USA
7. Mississippi State University	USA
8. Oakland University **	USA
9. Orange Coast College	USA
10. Purdue University **	USA
11. Rose-Hulman Institute	USA
12. Simon Frazier University	Canada
13. Southern College of Technology	USA
14. Stanford University	USA
15. Texas Tech University	USA
16. University of Arizona	USA
17. University of Central Florida **	USA
18. University of Southern California	USA
19. University of Tennessee	USA
20. University of Texas at Arlington **	USA

*\*\* Those making it to the final day of the competition*

## Teams meeting the application deadline

which was essentially four hobby helicopters strapped together nose-inward in a composite frame. Navigation systems have been acoustic arrays, laser sheet followers, GPS, optical trackers and the ever-favorite (and ever-failing) "dead reckoning." Devices for acquiring objects on the ground have ranged from machine vision-guided rare-earth magnets on reels to electromagnet arrays with flux coupling sen-

sors to tethered sub-robots with mechanical grabbers. Telemetry-to-ground computer equipment is allowed under the rules, though some teams have elegantly attempted to put all of the processing onboard.

## HIGH SCHOOL/OPEN CLASS

For the first time, a "High School/Open Class" version of the International Aerial Robotics Competition has been established. Ever since the airing of the Scientific American Frontiers program "Flying High," which featured a high school team attempting to perform the collegiate competition mission in 1995, there has been a great deal of interest expressed by high school science teachers and robotics clubs for a way in which they could play along.

This event has been scaled in difficulty to an advanced high school level, and will run concurrently with the collegiate competition. It's open to high schools and organized robotics clubs.

## HOW CAN YOU PLAY?

Those who desire more information about aerial robotics and past competitions or those who want to field a future team and wish to see the official rules for the 1997 competition will want to go to the World Wide Web address: <http://avdil.gtri.gatech.edu/AUVS/IARCLaunchPoint.html>. ★



### About the author

The International Aerial Robotics Competition was created in 1990 by Robert Michelson, who is past president of the Association for Unmanned Vehicle Systems Intl. (AUVSI), which has sponsored this unique engineering challenge for over half a decade.

Michelson is principal research engineer at the Georgia Tech Research Institute and is an adjunct associate professor in the School of Aerospace Engineering at the Georgia Institute of Technology in Atlanta, GA, where he teaches classes in avionics for unmanned aerial vehicles.

Nationally recognized in the field of unmanned aerial vehicle (UAV) research, Michelson has served on NATO working groups considering future UAV technology and is program director for a Traffic Surveillance Drone project funded by the Georgia Department of Transportation and the Federal Highway Administration's Priority Technology Program.

He is also key to the Institute's efforts to develop a MicroFlyer for the Defense Advanced Research Projects Agency (DARPA) and other federal agencies (see July '96 Model Airplane News, page 192).



MODEL  
AIRPLANE  
NEWS  
**FIELD &  
BENCH  
REVIEW**



MAJOR HOBBIES  
**Mystery  
Ship**

An  
*inexpensive,  
full-house  
sailplane*

by BOB AMICO

**I** RETURNED from a wonderfully informative weekend in Portland, ME, attending the Sailplane Symposium sponsored by the Down East Soaring Society. It was well-attended, well-sponsored and worth the six hours we drove to get there. I recommend it for soaring enthusiasts. I toured the Symposium with my two co-pilots, Frank Perozzi and George Mezzetler, and returned with a Major Hobbies\* Mystery Ship. The Mystery Ship is the first door prize I have ever won. And what a prize! I came away with the best possible plane for me, and at the time, I didn't even know it.

### CONSTRUCTION

The kit appeared to be pretty straightforward with laser-cut balsa and ply, plans and hardware. The first two pages of the instructions showed all the part numbers on the plans, so I thought, "This isn't gonna be so bad." But flaps? Ailerons? A full flying T-tail? Uh-oh!

Following the instructions, I started with an inboard wing panel, then numbered the

ribs. I then cut the LE to length and started trimming the  $\frac{1}{16} \times 3 \times 36$ -inch bottom sheeting. As I laid out my parts on the plans, I hit my first question: is the center sheeting wider than 3 inches? I can read plans, and no line showed a seam. Hmm ... was I wrong? I called Major Hobbies. "Hello, I'm working on the Mystery Ship ...." Bob Martin patiently listened as I explained. "Well," he said, "you're right; we don't

PHOTOS BY BOB AMICO





show a seam there, but most modelers know to go ahead and make one." (Let's all remember my skill level here.) I felt foolish, but Bob reassured me and told me to call anytime.

I reinforced the main spars, top and bottom, with 0.007x1/4-inch iron-on carbon fiber, something I've always done. On to the opposite side, and then to the outer tip panels. I glassed the wingtips for strength.

I was slightly confused with the ply braces mating with the inner and outer

sides. I examined the plan very carefully, as it took me a while to understand the 1/4-inch-square balsa fuselage doublers. The canopy is temporarily tacked into place, then it's cut away later. Only after I understood the design was I able to appreciate it. I installed a hatch (not on the plan) just aft of the wing rod to facilitate access to the Deans\* connectors, in case the wires fell into the fuselage.

On to the rear. The vertical fin assembly was a little difficult for me, as I had never built a full flying T-tail before. (I learned a lot while building this plane!) You must create two balsa spacers to fit between the two halves of the horizontal stab and vertical stab. A photo in the instructions might have helped me out here.

Rudder construction was no problem, although I replaced the balsa rudder bottom with a light hardwood to avoid any problems with my pull/pull system design.

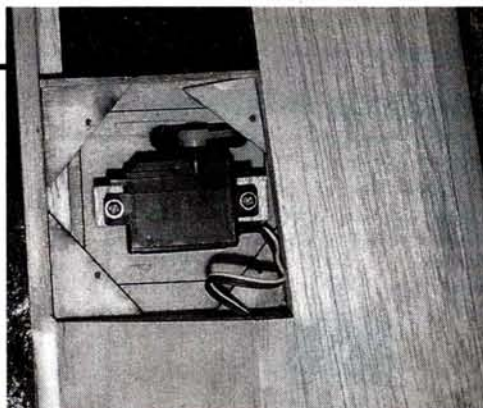
The horizontal stab halves are built in a jig created from the outer cuttings of the stab ribs. Maybe this isn't new to anyone else, but to me, this was the most fantastic method of putting together a stab that I had ever seen. It created the smoothest, most perfectly formed stabilizer I've ever built.

I used the Airtronics\* 94141 servos that came with my Stylus. I used Deans connectors on all my wing wiring, and all the servos lit up on the first try! I installed servo rails as per the plan, screwed in my pull/pull rudder servo in the rear and elevator servo up front.

I installed the tow-hook as per the plan, although I used a Ziegelmeyer\* tow-hook instead of the supplied hook. I sheeted the top and bottom of the fuselage and moved on to covering.

Goldberg\* Ultracote was used throughout—black, white and hot pink for color accents. Scotch no. 600 tape was used for hinging on the aileron and flaps.

I painted and polyurethaned the nose, put some Sky Shine on the leading edges and made final adjustments and inspections. Balancing required close to 9 ounces of weight added to the 7 ounces recommended in the plan. I built the 7 ounces into the nose after hollowing out a portion of it.



Left wing close-up showing aileron servo. Note the carbon-fiber mat reinforcement of the wing joint.

## AT THE FIELD

Flight day arrived (I was nervous as a hen). I put her together, range checked and went over all control surfaces for correct throws. Everything seemed in order, so we proceeded on with a few test glides. I threw; my flying buddy Frank Perozzi flew. First toss yielded a rather short flight with a slight left turn and a rather quick descent. I removed weight from the nose till she floated like a charm. On to the first launch. We chose to high-start, rather than winch,

## SPECIFICATIONS

**Model:** Mystery Ship

**Type:** sailplane

**Manufacturer:** Major Hobbies

**Wingspan:** 118 in.

**Wing area:** 973 sq. in.

**Weight:** 62 to 68 oz.

**Wing loading:** 8.8 to 10 oz./sq. ft.

**Length:** 53 1/4 in.

**Radio req'd:** min. 4 channels, 6 recommended

**Radio used:** Airtronics Stylus

**List price:** \$149.95

**Features:** an all laser-cut wood kit with plans, a complete hardware package and photo-illustrated instructions.

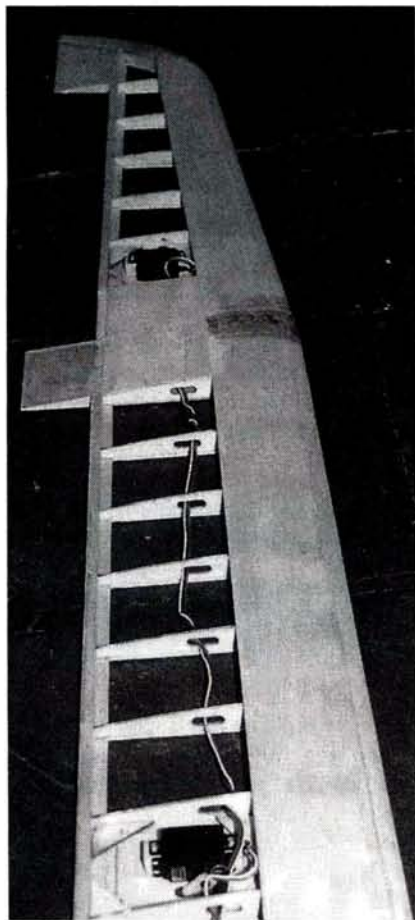
**Comments:** this is a great model for someone who wants to move up to a sailplane with flaps, ailerons and a full flying tail. Major Hobbies also provides excellent customer service support.

### Hits

- Excellent quality throughout.
- Mapped plan referencing.
- Complete hardware package.
- Stable and predictable.

### Misses

- Some more photos in the instructions would have helped during construction.



Left wing showing servos and wiring.

panels. They all appeared about 1/8 inch too high. After much thought, I decided it was OK to trim them. It worked.

Since I'm a lover of pull/pull rudder assemblies (I've used them on all my other planes), I planned to use one on this kit. I wanted to keep this ship extra light, so I investigated using some Teflon™-sleeved Kevlar cord from Aerospace Composites.\*

## FUSELAGE AND RUDDER

Fuselage construction began with the supplied, perfectly cut 1/8-inch lite-ply



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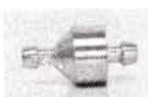
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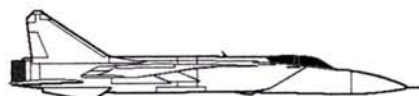
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# FLIGHT PERFORMANCE

## • Takeoff and landing

Launches were straight and easy with a heavy-duty high-start. Slight down flaps did not produce a noticeable effect; however, I believe the high-start doesn't have

the power to produce enough speed on launch for flaps to be effective in launch mode. I believe there will be an effect once we put it on the winch.

Landing with flaps was a new experience for me, but after a few radio adjustments to the "flap/elevator" mix, I was able to enjoy the benefits, bring her in slow and straight and drop her at my feet.

## • Low-speed performance

The Mystery Ship loves it slow and flies oh-so-delicately in slow flight, although aileron effectiveness suffered. I should not be too quick to judge here, as much more fine-tuning to the radio and the plane can only improve it. Elevator effectiveness is very precise, and only very slight changes produce significant effects due to the full flying stab. Be careful here.

Stalls were straightforward and quick to recover from, with a slight left wing down attitude.

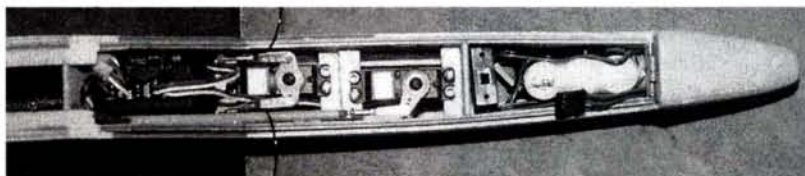
## • High-speed performance

Only a few clicks down, and you'll experience her high-speed performance, which the Mystery Ship handles well. I believe as I continue to trim and fly, this plane will be an excellent high-speed performer.



the first day until I was more confident and to avoid any undue stress on a new plane. With a mighty heave, off she went—a nice launch with slight tendency to veer left. Hmmm .... It took a full

and was stable and predictable with no adverse tendencies. This was an excellent step-up ship for me! I am very pleased with the result and would definitely recommend this kit to anyone



Nose view with servos and battery installed.



Wingtip showing .58-ounce fiberglass reinforcement covered with two coats of EZ LAM finishing resin.

ounce of lead on the right wingtip to bring her into lateral balance! My fault, but there was a lesson to be learned: don't assume your wings are equal in weight; lateral balancing is important! I remembered that I had used two slightly different gauges of wire in each wing.

The Mystery Ship flew beautifully

who enjoys building and is moving up the line to a "full-house" 6-channel model. A lot of time and effort went into it, but oh, did I learn a lot!

[Editors' note: Bob Amico received an early production kit; the plans, parts fit and wing sheeting location and balance point on current kits have since been corrected.]

\*Addresses are listed alphabetically in the Index of Manufacturers on page 123.

## About the author

Bob Amico claims to be "merely a novice" in the sport, having only a Paragon, Ollie and a Bird of Time to his credit. (All still flying, by the way!) He would like to thank his flying buddy Frank Perozzi and modeling mentor George Mezzetler, whom Bob says he could never thank enough "for all his master machinist experience and 25 years of modeling that he has shared with us; he truly exemplifies a man whom anyone entering our hobby would be proud to have as a teacher."



23RD ANNUAL

# Visalia

**The largest U.S.  
thermal duration contest**

## Fall

# Soaring Festival

by MIKE LEE

**S**AILPLANE COMPETITION—the modeling world's silent sport—has reached enormous proportions in terms of participation and popularity. While this type of flying is not new to R/C, for many pilots, the challenge of non-powered, sustained flight is attractive as a personal challenge and as sporting competition, man-on-man.

Officially known as the 23rd Annual Visalia Fall Soaring Festival, this sailplane meet is the largest thermal duration competition in North America and possibly the world. With over 275 entries registered, the Soaring Festival outstrips attendance of the AMA Nationals by over twice the number of pilots. What makes this contest so popular can be attributed to several factors.

The Visalia, CA, site is very well-done, with lots of open space, good



Viewed from inside a twin Beechcraft, the field is seen covered with pilots and planes. This is only the landing area.



Don Edberg gives the heave to his ship on an official flight. Don writes the "Soaring" column for R/C Modeler.



Keith Finkenbinder adjusts the flaps of his Airtronics Sapphire just prior to a launch. Keith took the Gray Cup class by storm.



Joe Wurts and his wife, Jan, stand proudly behind their Airtronics Sapphire that Joe piloted to first place in Open class. Joe had quite a bit to do with the design of this attractive aircraft.

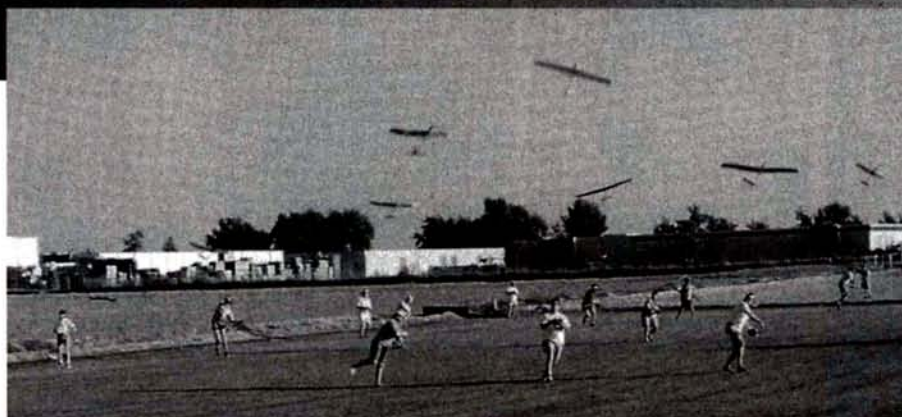


Mike Deckman has his Illegal Eagle going straight up the tow for a perfect launch.



The contingent from New Zealand pose with their ships and flag. From left, Dave Griffin, Angus McDonald and Laurie Jackson. They used connections on the Internet to arrange the trip to Visalia.





A mass launch by 15 hand-launch pilots during a Saturday evening mini-contest. There were a lot of fun things going on besides the contest, and hand-launch was one of the best.

launch facilities and good landing areas. Visalia has been holding the meet for 23 consecutive years, making it one of the oldest-running meets for sailplanes. Entries for pre-registration are opened for acceptance on August 1 of each year. No entry postmarked before this date is allowed. Believe it or not, the entire field of 275 positions is filled by entries postmarked on this one date! If you waited one day, you were too late to make the field. How's that for popularity?

Mr. Phil Hill was the CD this year. Under his direction, the CVRC club was ready for the competition two days prior to the first official flight. Many pilots arrived as early as a week before to practice and enjoy the company of old friends. I know that a big factor that attracts many pilots is the huge raffle that is held on Sunday, after the competition. Everything from blankets, motor oil and barbecue pits to radios, aircraft kits and building equipment is given away in this raffle that

brings in precious funds to keep the CVRC club running.

### SILENT FLIGHTS

The task was thermal duration flying, with four flights on Saturday and three on Sunday. Saturday flights consisted of 3-, 5-, 7- and 4-minute tasks, in that order. Pilots were required to fly in called flight order, eliminating the ability of pilots to sandbag their flight until lift was absolutely assured. Sunday flights saw a 3-, 6- and 8-minute task requirement. Now, for you powered aircraft pilots, a 3-minute flight may not seem like a hard thing to accomplish. However, just try taking a plane to only 300 feet of altitude, shut down the engine completely and then glide for 3 minutes, nothing over or under that time. Add to this task a landing in a triangle landing zone with the tip of the triangle at your feet. You must land on time and within the triangle, with more points awarded for being closer to the tip of the triangle. There aren't too many pilots out there who can accomplish this task under the heat of competition. If you can, try the 8-minute task.

Almost every hot pilot in the country showed up to see who could be the top dog. Pilots from New York, Connecticut and Illinois were present, but that's just for the domestic pilots. Teams hailing from Germany, England and New Zealand were attracted to fly at Visalia—truly an international field of pilots! I was especially honored to talk with the New Zealand pilots, who are about as open and friendly



Tim Renaud has the bird on the wing during launch for his flight in the contest. Airtronics Sapphire.

## WINNERS

Position Pilot

### OPEN CLASS

- 1 ..... Joe Wurts
- 2 ..... Greg Johns
- 3 ..... Steve Condon
- 4 ..... Keith Kindrick
- 5 ..... Art Markiewicz

### 2-METER CLASS

- 1 ..... Jerry Robertson
- 2 ..... David Layne
- 3 ..... Brian Laird

### GRAY CUP

- 1 ..... Keith Finkenbinder
- 2 ..... Nick Buzolich
- 3 ..... Ron Brown

### NOSTALGIA CLASS

- 1 ..... Don McNamee
- 2 ..... Bob Sliff
- 3 ..... Phil Bauer

### JUNIOR CLASS

- 1 ..... Ali Khani
- 2 ..... Thomas Akers



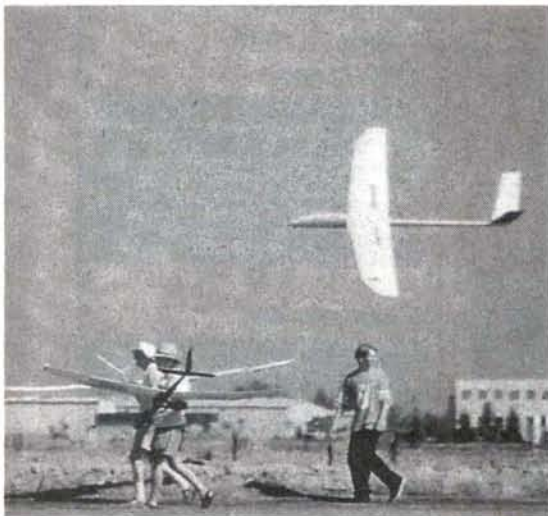
Open class top five pilots, from left, Art Markiewicz, 5th; Keith Kindrick, 4th; Steve Condon, 3rd; Greg Johns, 2nd; and former World Champion Joe Wurts, 1st place. Tough competition in this crowd.

as you can find. They not only flew well but had a great time doing so. (By the way, the New Zealanders made the hook-up via Internet, conversing and making arrangements to arrive in the U.S. with pilots from California. Surf the Net, anyone?)

### TASK EQUIPMENT

Of the planes I observed in the competition, I saw three distinct styles of the modern, high-tech sailplane breed. While darn near everything had a modern airfoil, such as the Selig-Donovan's HQ and RG-type airfoils, the layouts of the aircraft were found to be T-tailed, cruciform, or V-tailed. Indeed, many of the ships within each style looked extremely similar, making it difficult for the





untrained eye to tell the difference. This fact made things confusing at times in the air, as up to 19 planes could be seen in the sky at one time, in the same area—a challenging situation for the pilot.

Other aircraft styles were decidedly different due to the class in which they were entered. Visalia includes a Nostalgia class for older aircraft designs using rudder, elevator and spoilers only. These birds include the Bird of Time, Oly II, Cumic and Paragon—classic designs that still perform very well



**Above: Dave Garwood, soaring columnist for Model Aviation, stands with his 2-meter Vaquero. This all-molded ship is quite clean-looking. Above right: Junior Class winners display their hard-earned plaques. On left, Ali Khani, and Thomas Akers.**



today. Two other classes flown at the meet were 2-Meter and the Gray Cup class for pilots aged 62 years young. Within the classes, awards were available for the high-scoring Junior age pilots. This is a great idea that promotes flying from our youth groups.

I had two memorable highlights of the Visalia meet that made it worth my while to be there. The first was to fly in a full-scale twin Beechcraft with pilot John Wilson. On this hop, several news media people, including myself, were treated to some low-level passes over the flying site for a gorgeous

photo pass. Model pilots were spread across the turf with their ships while John buzzed the field. A couple of the other reporters were not really prepared for this minor flogging in the air and were a bit "uneasy." I was hoping we could get even lower!

The second was the great barbecue dinner on Saturday evening. Not only was the food terrific, but the atmosphere was second to none. While a banjo and string band played on the field, pilots and friends gathered to socialize and trade stories. The camp I was in featured yet another barbecue hosted by the Inland Soaring Society with master chef

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Todd Billman. Todd can cook a pretty mean meal, and his handiwork managed to attract a few guests, like Joe Wurts. Overhead, we noted half a dozen planes with glow sticks mounted on them performing night flight missions. It doesn't get any better than this.

## PRODUCT PEEKS

Visalia is also noted for having a showplace-type atmosphere. Manufacturers and suppliers of sailplane products set up tents and booths with products for modelers to drool over. Airtronics\*

was showing the new Sapphire in both foam with obechi sheeting and an all-molded version. They also had a new hand-launch bird plus the Stylus radio system on display.

California Soaring Products\* featured the Mystic sailplane kit, utilizing a 7037 airfoil and triple-taper wing. An attractive design. Northeast Sailplane Products\* had the new Victory C sailplane for Open class as well as the Sisu 2-meter bird. Mark Levoe of Levoe Design\* was flying his patented Super-Vee



**Skip Miller plants it in the middle scoring zone of the triangle for a bonus on the flight score.**

design in between showing the bird in his booth. Dave Layne caught my eye with a neat Speed 400 electric pylon racer sitting next to his Saturn Open class planes. As you can tell, this contest is a modelers' playhouse.

## TOUGH COMPETITION

As for the contest, this was not a give-away sailplane meet. Competition was keen, and the air for thermalling was finicky. Birds with excellent hunting abilities were at an advantage in finding lift. Many a pilot who could not hunt was found scrambling to make time any which way he could, often failing to make it back to the landing zones.

By the final round on Sunday, the top 50 pilots in Open class were tightly bunched up in the points standings. At this point, many of these pilots had to "go for broke" in a last-chance effort to catch the leaders. This last chance was found in the form of a pie-plate-size circle located about 3 feet behind the

landing triangle, towards the pilot. If the nose of the plane came to rest in that tiny circle, the reward was a 25% scoring bonus—enough to carry you from 50th to the top 10! Only a couple of pilots managed this feat under the intense pressure of competition, with some pilots missing the landing zones altogether and actually lowering their scores.

At the top of the heap in Open class was former world champion Joe Wurts, flying an Airtronics Sapphire. Joe never hit the pie-plate landing circle, instead opting to make more conservative landings in the triangular zone where points were lower but easier. Second place went to Greg Johns, who trailed by less than .1% in this meet worth 8,000 possible points.

This was really an outstanding event for the participants as well as spectators. There was plenty to see and plenty to shop for at this event, with lots of free advice and help from everyone. It is little wonder why this event attracts so many, and no doubt, it should be the model by which other contests could be made from. I am definitely going to make this contest one of my annual "must do" events from now on.

\*Addresses are listed alphabetically in the Index of Manufacturers on page 123.

## ADVERTISEMENT

# SR Techniques

*Techniques* is a new concept in modeling. It isn't a magazine, or a book. Instead, *Techniques* is an archive of modeling knowledge and expertise. In *Techniques* you'll find some of the most respected modelers in the country sharing their personal modeling tips and techniques.

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(Electric Flight), Paul Tradelius (Helicopters), and Don Typond (Finishing).

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# The *Wild*est Cat

MODEL AIRPLANE NEWS  
**CONSTRUCTION**

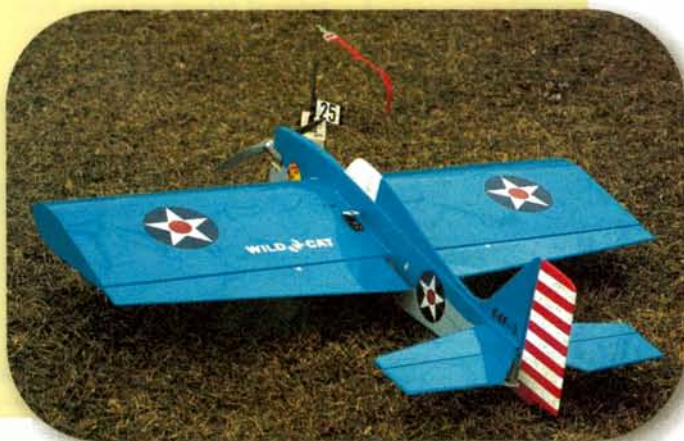
by BOB STEELE



**M**ANY MODELERS know the Grumman Wildcat. It was the U.S. Navy's first shipboard monoplane fighter, and the first Navy airplane to take the measure of the famed Japanese Zero. It was the fighter that helped to turn the tide at the decisive battles of Coral Sea and Midway, and in its U.S. Marine version, it fought in the skies over Guadalcanal.

But, as important as the F4F-3 Wildcat was in the early stages of the War, it is seldom modeled, probably for two reasons. First, the fuselage is very round and hard to duplicate, and second, the landing has a very narrow track and is very difficult to reproduce. Of course, in stand-off scale or stand-way-off scale, these factors aren't so important. With the popularity of profile fun-fly airplanes growing, I thought the Wildcat a natural for this type of construction. Let's build one!

*A fun-to-fly, profile Navy fighter*





## THE WILDEST CAT

### CONSTRUCTION

Building the fuselage is relatively painless, but the construction sequence should be closely followed to avoid problems later. The first step is to form

the lower longeron and placed the soaked end of the longeron between the rows of nails and let it dry for 4 to 6 hours. Do not drive any nails through the longeron itself.

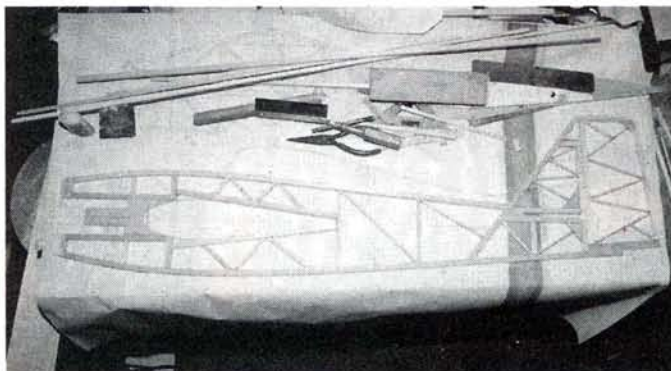
When completely dry, the longeron holds its shape nicely. Remove the first longeron from the jig and do the same thing to the top longeron. The top and bottom longerons are nearly identical and the jig can be used to form both.

Now tack the plan down to your building bench and cover it with wax paper. Cut the engine-mount

spacer out of 1/4-inch sheet balsa and pin it into place. Select one of the formed longerons and pin it in the bottom longeron position. Build the fin and the

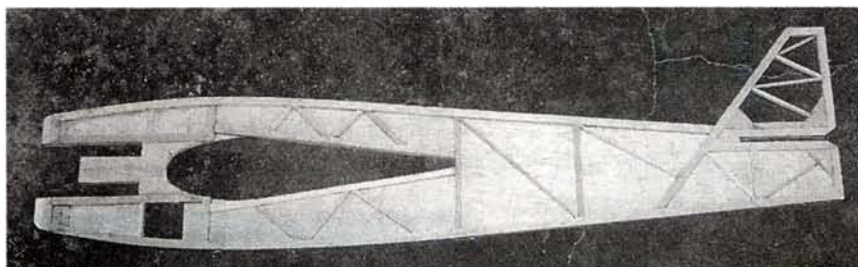
the plan and prepare the 1/8-inch balsa fuselage sides by edge gluing two 1/8x4x36-inch balsa sheets together with thin CA. The resulting sheet needs to be trimmed as shown on the plan, from the dorsal fin rearward before it's glued into place. Tack-glue the sheeting into place with thin CA and turn the entire assembly over to finish gluing. Wick thin CA around all the structural members and the engine mount spacer to bond the sheeting into place. Now cut out the slot for the stabilizer as well as the areas for the wing, landing gear mount block and the maple engine mount rails. When this has been completed, do the same for the sheeting on the opposite side.

Using 30-minute epoxy, glue two pieces of 1/4-inch-thick aircraft plywood together to form a 1/2-inch-thick block. Epoxy this block into the landing gear mount opening. Now epoxy the engine-mount rails into place and let dry. Put the fuselage aside for now as we'll add the two 1/8-inch-thick lite-ply fuselage doublers after the wing has been attached.



*After the top and bottom fuselage longerons have been formed on a forming jig, the fuselage is built flat over the plans on the workbench. Note that the vertical fin is built as part of the fuselage structure.*

(bend) the top and bottom 1/4x3/8x36-inch fuselage longerons. I used a pine board about 2 feet long for a forming jig and pinned down the plan and covered it with a piece of wax paper. I then drove several 18-gauge picture-hanging nails along the top edge of the lower fuselage longeron. I soaked the first 12 to 14 inches of the longeron in a mixture of warm water and a half cup of ammonia for about a half hour. I then drove a couple more nails along the bottom edge of



*Here the fuselage has the right side sheeting attached. Note the openings for the wing, engine-mount rails and landing-gear mount block.*

### SPECIFICATIONS

**Name:** WILDest CAT

**Type:** fun-fly profile warbird

**Wingspan:** 45.5 in.

**Airfoil:** fully symmetrical

**Weight:** 4lb., 5oz.

**Wing area:** 747.75 sq. in.

**Wing loading:** 13.29 oz./sq. ft.

**No. of channels req'd:** 4 (aileron, elevator, rudder and throttle)

**Engine req'd:** .32 to .46 2-stroke

**Engine used:** SuperTigre .40

**Prop used:** 11x4

**Features:** all wood construction, profile fuselage with wire landing gear. All the radio equipment is housed in the center section of the wing.

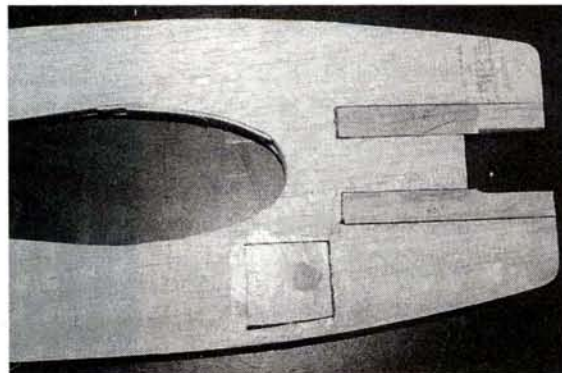
**Comments:** WILDest CAT is a fun to fly profile model of a WW II Grumman Wildcat. In a light breeze, it can almost hover, and with computer radio mixing, will do any maneuver in the book. Even without flap and elevator mixing, the model is a blast to fly.

stabilizer support and glue them to the lower longeron. I used thick CA for the basic fuselage construction. Be sure to include all diagonals and gussets. Now cut the upper longeron to length and pin it into place on the plan. Glue the 1/4-inch-square vertical members and the 1/4x3/8-inch wing mount pieces into place and then add all the other balsa structural members shown on the plan. Do not install the plywood landing gear mount or maple engine-mount rails yet.

With the fuselage frame still pinned to the board, cut to shape and glue into place the 1/4-inch-thick sheet canopy, the dorsal fin and gusset. When the glue has set up, remove the structure from

### STABILIZER, RUDDER AND AILERONS

Nothing much special here. Assemble all the parts over the plan, and don't forget to add the 1/4-inch-thick ply elevator joiner. Be sure to include all the gussets and diagonals and shape all outer edges



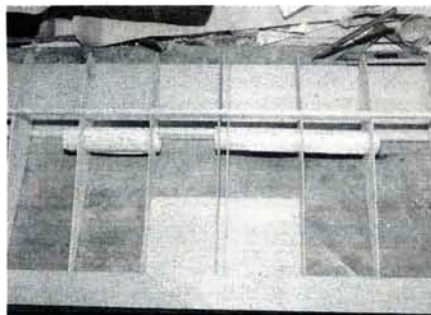
*Here the fuselage has the right side sheeting attached. Note the openings for the wing, engine-mount rails and landing-gear mount block.*



according to the plans. When cutting the pieces try to get a good fit and glue everything well.

## WING CONSTRUCTION

The wing is the heart of any plane—in this case, even more so since the thick wing is used to house the radio equipment, servos, batteries and all. All the ribs are of identical shape, so I made a rib template out of 1/8-inch ply to cut out 14 ribs from 1/16x3-inch sheet and two ribs from 1/8-inch sheet. Be sure both the top and bottom curves of the ribs are identical. Now take eight 1/16-inch-thick ribs

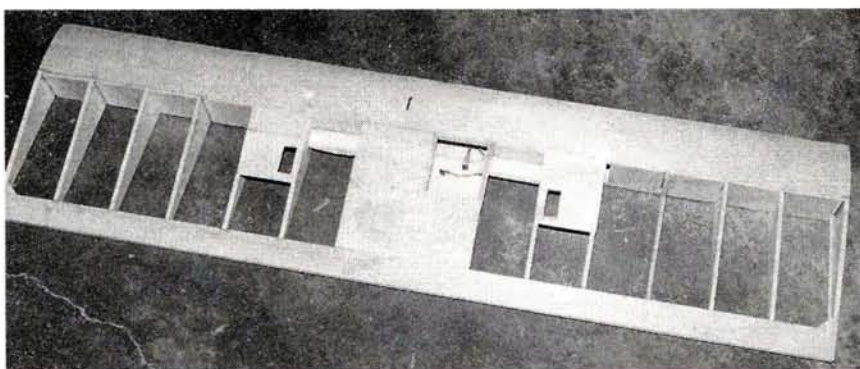


Early stages of wing construction. All the ribs are identical. Note the main spar doubler installed in the wing center section.

and one 1/8-inch rib and drill an 1/8-inch hole in the front of them for the antenna-lead tubing. These are the ribs for the right wing. Select four 1/16-inch ribs—one plain and three with antenna holes—and cut the 1/4-inch-wide slots 1/2 inch deep for the spruce spar doublers. Also cut the 1-inch-diameter holes for the paper servo-lead tubes in the appropriate ribs. Select two ribs (the center pair) and, through both of them, cut a hole large enough to take the throttle servo lead. Be sure the hole is in an accessible spot. Now that the ribs are prepared, let's work on the 1/4x3/8x48-inch trailing edge (TE).

Take a hacksaw blade and break it in the middle and tape the two halves together to form a short saw blade about 1/16 inch thick. Mark the rib locations on the TE and use the saw to cut a 3/16-inch deep slot in the TE for each rib. Select two straight pieces of 1/4-inch-square spruce and cut them to the length of the main spars. From a third piece of spruce, cut the spar doublers to length (13 1/4 inches long), and glue them to the main spars with thick CA or epoxy. When the glue has dried, mark the locations of the ribs on the spars and begin putting the ribs into position. Do not glue yet. Be sure to put the previously prepared ribs in their proper locations. Slip the TE onto

the rear of the ribs and note that when properly installed, the TE does not quite lie flat on the plan. Make sure everything is straight and true and glue the ribs to the spar and TE. Glue the top spar into



Completed wing structure. Note the radio access hatch and the aileron servo mounts.

place and add the TE gussets. Glue the top TE sheeting into place before removing the wing from the building board. Flip the wing over and then add the bottom TE sheeting.

Starting with the bottom of the wing,

## • Takeoff and landing

The landing gear has a narrow track just as the full-scale ship did, and I thought perhaps it would be tricky to handle. Not so! Surprisingly, the model tracks nicely on takeoff, usually needing no right rudder

application as long as you are heading into the wind. I found that the plane will leave the ground smartly after a very short roll if you want it to; however, longer, smoother takeoff runs are easily performed. When it comes time to land, you'll discover that the WILDest CAT has a fine glide and no bad habits coming in. The music wire landing gear will take a jolt without bending and here again the narrow track gear will present no problems.

## • Low-speed performance

With a weight of only slightly over 4 pounds and a wing area of 747 square inches, it's not surprising that the WILDest CAT can fly at extremely slow speeds. In fact, in a slight breeze, if you're a good enough pilot, you can make the model hover. Control remains good. With the SuperTigre .40 engine, I have not been able to make the model stall, even during a snap-roll. The model flies through the maneuver much like a tight, powered corkscrew spin.



## • High-speed performance

The model feels very solid at high speed and doesn't have any snapping tendencies even during very tight turns. I have not experienced any flutter.

## • Aerobatics

The WILDest CAT was designed to look like an F4F-3 Wildcat and fly like the best fun-fly planes. Performance is very pleasing with my SuperTigre GS .40 turning an 11x4 prop. The profile fuselage lends itself to prolonged knife-edge flight, including knife-edge loops. The thick airfoil provides lots of lift while maintaining a constant speed. The fin and rudder were designed to avoid roll couple when rudder is applied, but the rudder is still quite effective both on the ground and in the air. Once in the air, the sky's the limit! Loops are very tight—about 3 feet in diameter both inside and outside, and this is without elevator and flap coupling. I think you'll find that this bird will do anything you ask of it.

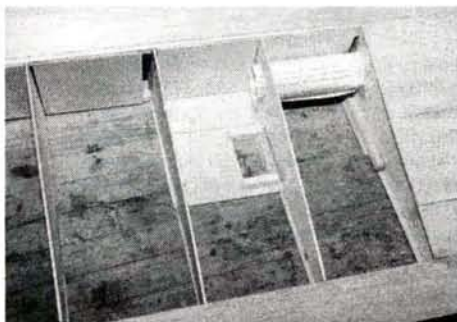
the front edge of the LE sheeting (1/16x4x48 inches) should be even with the front of each rib. To do this, work from the middle of the wing out to the wingtips, using thin CA to tack glue the

front edge of the sheeting into place. Then smooth the sheeting down so it makes good contact against the ribs and spar and glue it into place, again working from the middle of the wing out to the tips.

Next, cut the 1/64-inch ply radio com-



## THE WILDEST CAT



**Paper tubes are used as servo lead wire conduits to guide the leads to the radio compartment—simple and light.**

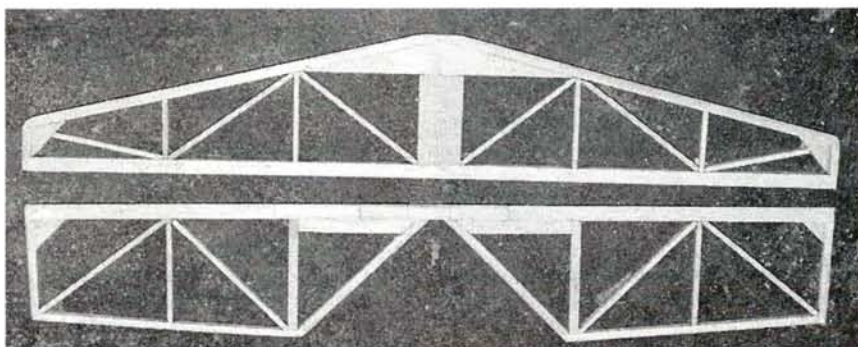
partment reinforcement to shape and glue it into place on the left side of the center ribs, followed by the  $\frac{1}{64}$  inch ply throttle servo mount on the right side of the center ribs. Install the antenna tubing. Seal the top surfaces of the  $\frac{1}{64}$ -inch ply with some thick CA or white glue so that the servo-mounting tape will stick properly. Install the throttle servo using the tape and the battery pack using hook-and-loop fastener. Now add the top LE sheet in the same way as you did the bottom. Add the  $\frac{1}{16}$ -inch vertical-grain shear webbing to the aft surface of the main spar but leave the center rib bays open.

To make it easy to route the aileron servo leads to the radio compartment, I made tubes out of plain bond paper to act as conduit. Take a sheet of  $8\frac{1}{2} \times 11$  paper and cut it into two pieces measuring  $8\frac{1}{2} \times 3\frac{1}{2}$  inches and  $8\frac{1}{2} \times 7\frac{1}{2}$  inches. Roll the pieces to make tubes, and install the short one in the left wing between the radio compartment and the aileron-servo bay. Insert the tubes into the large holes already cut into the ribs, and glue them into place.

Sand the front of the LE sheeting and the ribs straight and flat and then carefully glue the  $\frac{1}{4}$ -inch-thick LE to the wing. When the glue has dried, carve and sand

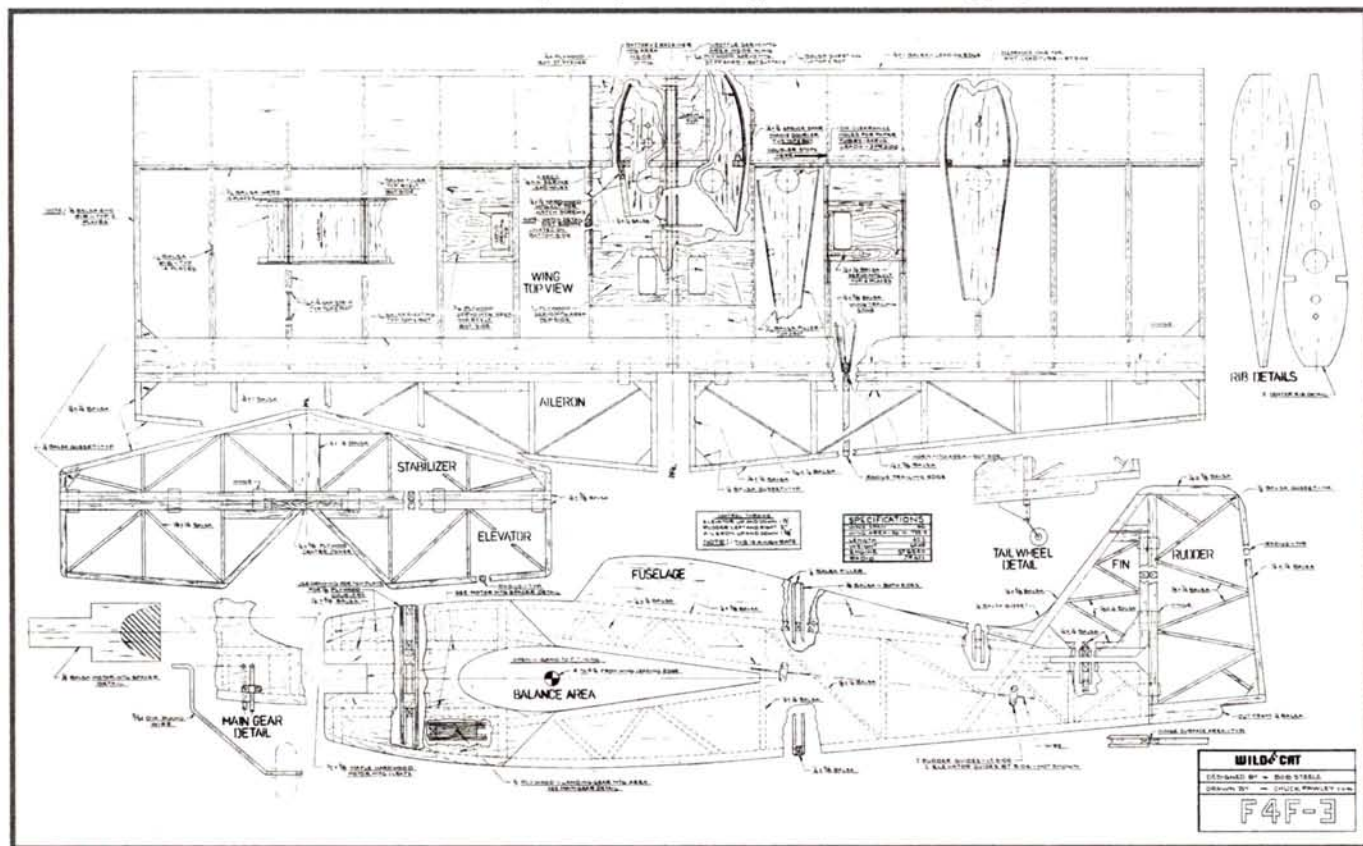
the LE to shape. Add the  $\frac{1}{16}$ -inch balsa sheeting and  $\frac{1}{16}$ -inch ply sheeting for the aileron servo mounts to the bottom surface of the wing. Cut out the servo holes before gluing the ply to the wing. Now add the bottom  $\frac{1}{16}$ -inch balsa center-section sheeting. Be sure to install the radio access hatch blocks and the  $\frac{1}{16}$ -inch ply hatch cover.

Prepare the  $\frac{1}{16}$ -inch ply mounts for the rudder and elevator servos and glue them to the top center wing section. Add  $\frac{1}{4}$ -inch square balsa braces to the underside of the ply servo-mount sheet, then complete the top wing sheeting. Glue on all the  $\frac{1}{16} \times \frac{1}{4}$ -inch rib cap-

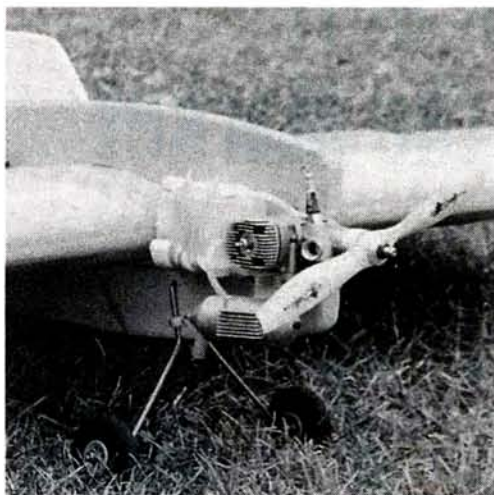


**The tail feathers are simple stick construction.**

**To order the full-size plans (FSP03971), see Pilots' Mart, page 121.**







**As with all profile fuselage designs, the engine and fuel tank and landing-gear installation is straightforward.**

strips, and when they're dry sand everything smooth.

### FINAL ASSEMBLY AND COVERING

The wing should be a rather tight slip-fit into the fuselage. If it is not, sand the high spots from the fuselage opening until the wing fits snugly. Choose your color scheme carefully since, when flying, you need to be able to recognize up from down very quickly. I chose the early 1942 color scheme and found it works out nicely. I used CGM\* Ultracote and Ultracote Plus for the covering.

Cover the stabilizer leaving a 1/2-inch uncovered strip in the center, so you'll be able to get a good glue joint at the fuselage. Cover the rudder, elevator and ailerons. Cover the fin and fuselage up to the point where the 1/8-inch lite-ply doublers will be glued. Glue the stabilizer to the fuselage and hinge the elevator to the stabilizer. I used Sig\* EZ hinges. Mount the tailwheel and fit the rudder to the fin and tailwheel mount as shown on the plans. Hinge the rudder to the fin.

Glue the uncovered wing to the fuselage, making sure everything is square and that the glue penetrates all the way through the wing cutout. When this assembly is dry, glue the lite-ply fuselage doublers into place. Now drill the engine-mount holes to fit your engine and the landing gear holes according to the plan. Cover the wing and the front of the fuselage and attach the ailerons. Bend the landing gear using heat, a hammer and vise, then install the landing gear using 5/32-inch landing-gear clamps.

### RADIO INSTALLATION

The rudder and elevator servos should both be mounted very close to the fuse-

lage sides so that the pushrod guides will be straight and able to do their jobs properly.

Place 3/8-inch-long pieces of scrap antenna-lead tubing in the four 1/8-inch landing-gear straps used as pushrod guides, and glue lightly with thin CA. Make a Z-bend at one end of all five pushrods and place the Z-bends in their respective servo output arms. Slip two of the pushrod guides over both the rudder and elevator pushrods then solder the brass threaded couplers onto the pushrods, and mount the large control horns before positioning the pushrod guides. To keep the pushrods in a straight line, keep the elevator control horn close to the fuselage. Screw the pushrod guides to the fuselage sides. Install the aileron pushrods; no guides are needed here. All pushrods

used an 11x4 prop on my SuperTigre\* GS .40 to keep speed down and power up. By this time, we should be ready for the first flight. Check the CG; it should be just on the back edge of the spar for normal flying. Move it back for better snap-roll and spin response.

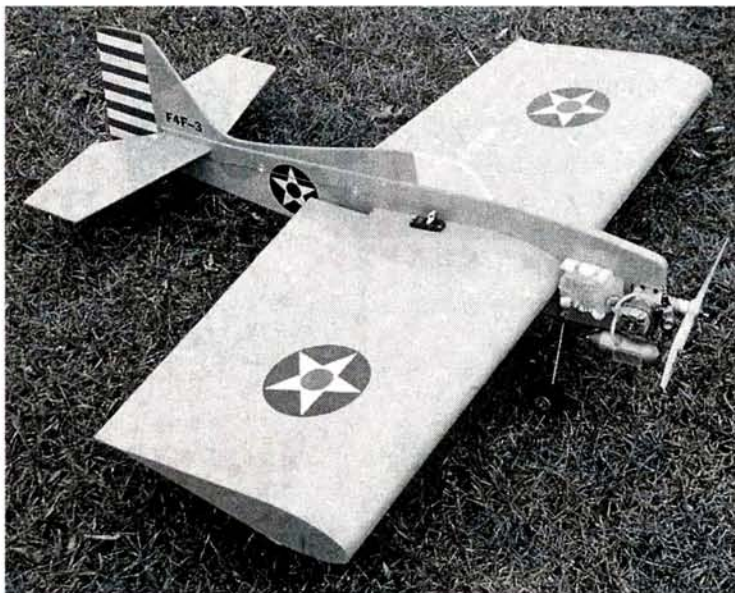
### Suggested control throws

- Elevator up and down—1 1/2 inches
- Rudder left and right—2 inches
- Aileron up and down—1 3/8 inches.

This aircraft, like all other caricature fun fly planes, benefits greatly from the use of exponential control throws or variable travel rate (VTR). If you do not have a computer radio, then set up your high and low rates so that you get the specified control travels on high rate and about half that on low rate, then test-fly on low rate!

If it's built according to the plan, I

**The completed WILDest CAT looks like it's waiting for its turn for a catapult launch from a profile aircraft carrier. Hey! If I had a tail hook and some arresting cables ....**



should be in the holes farthest out on the servo arms for maximum mechanical advantage.

Plug all servos into their respective slots in the receiver, and install your switch and charge jack in the top of the left wing where no fuel will creep in. Wrap the receiver in 1/4-inch foam and stuff it in place along with the battery pack. Run the receiver antenna out through the lead-out tube and your radio installation is complete. Install your engine, leaving enough room to fit the fuel tank directly behind it. I wrapped my tank in foam then secured it to the fuselage using no. 32 rubber bands and 1 1/2-inch-long L-shaped cup hooks. I

think you'll be proud of this little World War II fighter, and I'm sure you'll find it one of your favorite aircraft at the flying field!

*\*Addresses are listed alphabetically in the Index of Manufacturers on page 123.*

### About the Author

Born and raised in Fort Wayne, IN, Bob Steele started flying models in 1947 and got into R/C in 1955. He built many radios from kits and learned to fly on a Galloping Ghost system. Bob flew for many years in pattern competition and switched to sailplanes in 1970. He is still involved with powered models and is currently the president of the League of Silent Flight (LSF).





# Scale **TECHNIQUES**

by **BOB UNDERWOOD**

## WHEELS, WHEELS, WHEELS!

**N**OT TOO MANY years ago, one of the biggest stumbling blocks to creating a scale project was finding wheels. While you could usually find the correct diameter, other features were lacking—right diameter, but wrong width, style, tread, hub, or what have you. Recently, it seems like almost every month, articles contain information about new and improved wheels.

The latest attempts at producing better wheels have reduced weight. Additionally, manufacturers have worked harder at producing tire and

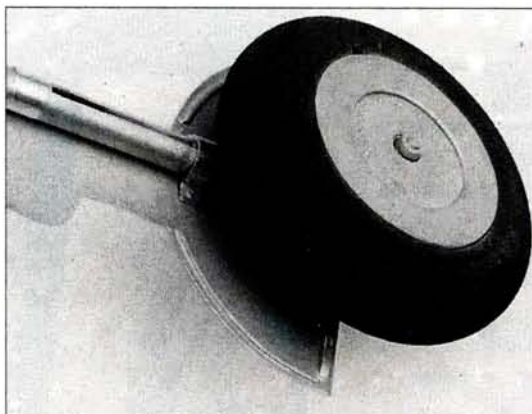
through catalogues and back issues of magazines to locate the correct size, shape, etc., for your project.

### HEAVINESS AND HUBS

One concern that you may need to address is the weight of the wheels. There is a terrific range. Obviously, size is one reason some are heavier than others! But that is not the sole determining factor. Consideration of wheels for a project your author has under way resulted in finding one set available weighing in at 12 ounces each. Another brand tipped the scales at 5 ounces. Bingo! A savings of almost a pound!

The hub is another consideration. Hubs are usually made of wood, plastic, or metal. Granted, the wooden-hubbed Trexler wheels are generally suggested for lighter, vintage-type models, but actually, I have used them in a rather unusual way. Faced with having to duplicate a difficult tire shape, I used the plastic (liquid "rubber"?) found in tubes at the hardware store to build up the outside shape of a standard narrow tire. The hollow Trexler tire was then slit open at the hub area and the reformed tire inserted inside. When reinstalled on the hub, I had a neat representation of the full-size aircraft tire.

A few warnings: if you have to drill out a plastic or wooden hub, be very careful. First, make certain the hub is flat on the surface and the drill is at a 90-degree angle. Second, go very slowly, especially in the plastic. The bit can have a tendency to grab



*Wheels for a Russian LA5 fashioned from Dave Brown Products wheels. You can barely see the cross tread on the outer surface of the tire. The hubs are cover plates made of plywood.*

and spiral its way through, not actually "drilling" a clean hole. I sometimes shim the hole with a piece of metal tube for a better fit.

### MAKE YOUR OWN!

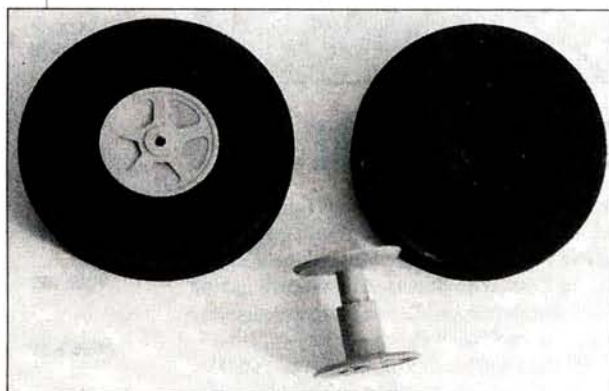
Now, what can you do if *nothing* on the market fits your needs? Modify a set of Dave Brown Products\* wheels! Ranging in size from 1 to 6 inches in several styles, they are very light. The styles include rounded, smooth and treaded, as well as flat. (No, not "flat" as in "a flat tire on my car"; they have a flat tread surface!)

These tires are made of a very dense foam material. Although they can wear rather rapidly if skidded on asphalt and they do look somewhat grainy and "un-rubber-like" up close, they have one important quality: they can be easily shaped!

There are several ways to accomplish this. By running a bolt through the hub and securing it with a nut, you can chuck the tire into an electric drill or drill press. Then, using various grades of sandpaper, a rasp, or even wood-turning tools, you can create the shape or size needed. Be very careful not to take off too much too quickly. It is very easy to gouge and tear the material.

It pays to make a contour gauge to test your work as you go along. This is especially true if the outside shape contains unusual contours. Some tires have "ledges" or sidewall shapes that are a little different.

Does the tire need treads that run straight around its circumference?



*Dave Brown Products wheels. The hubs slide apart and can be adjusted for balloon-shaped tires by cutting the insert pieces.*

hub combinations that cut down on separations under side load. Both of these features are very much appreciated. The window-dressing provided by improved hubs is also nice, although with many aircraft—no matter how many wheel styles are available—some modification will be needed to match the aircraft being modeled.

In some cases, you can find very specific types among wheels that have been produced for many years. For instance, Williams Brothers\* produced a variety known as Smooth Contour that are an excellent copy of wheels used from the 1930s to WW II. Spend some time looking



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# SIMULATION WITHOUT TRIM...



## IS LIKE A PINE TREE WITHOUT TRIM.

So you're asking yourself, "What is so important about having realistic trims on a r/c simulator?"

Now ask yourself, "What is so important about having trim on a Christmas tree?"

A Christmas tree without any of the lights, tinsel, ornaments or garland is just a pine tree; no different than any other pine tree in the forest.

In r/c simulation, trims play a vital role in allowing the pilot to make minor corrections to keep the model flying straight and true. If realistic trims are not supplied, the simulation is simply a video game.

That's why we took the steps to include fully realistic trims on our simulated transmitter.

These trims work just by moving them - no keyboard commands or complicated steps to remember.

The realism doesn't stop there. We've also included dual rate switches and competition quality gimbal assemblies featuring user-adjustable spring tension.

Just think, if we put this much effort and foresight to make our controls as realistic as possible, imagine the realism we programmed into the software...



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- COMES WITH CONTROLLER

SOUTHERN'S SORCHUM • MIKAMATIC 30 MIN EPOXY • FASTMATIC 5 MINUTE EPOXY • STRABILIZER TRANSMITTER TRAY • FIBERGLASS PUSH-ROD SYSTEM • MICRO-LESS STARTER PACK • FIBERGLASS PUSH-ROD SYSTEM • MICRO-LESS STARTER PACK

SOUTHERN'S SORCHUM • MIKAMATIC 30 MIN EPOXY • FASTMATIC 5 MINUTE EPOXY • STRABILIZER TRANSMITTER TRAY • FIBERGLASS PUSH-ROD SYSTEM • MICRO-LESS STARTER PACK • FIBERGLASS PUSH-ROD SYSTEM • MICRO-LESS STARTER PACK

## Scale TECHNIQUES

These grooves are easy to create; a hack-saw blade or a sandpaper-covered stick will fit the bill.

I have heard of individuals who place the wheels in a freezer prior to working them. It is said that this makes the material easier to sand or grind. Frankly, I have never tried this for two reasons. I've never had the foresight to think about doing it prior to working on the wheels, and I've never felt it necessary.

I shape mine using an inexpensive Sears wood lathe. It's easier and creates a truer shape. By using the screw center, you can



*Though a drill press or electric hand drill can be used to spin the wheel for shaping, the easiest and truest method is to use a screw center and a wood lathe. Make certain to seat the hub against the screw-center backplate.*

simply screw the hub on until it seats against the backplate. You'll have to drill out the hub and shim it with a metal tube after the shaping process, because the screw center will leave a "squirrely" hole.

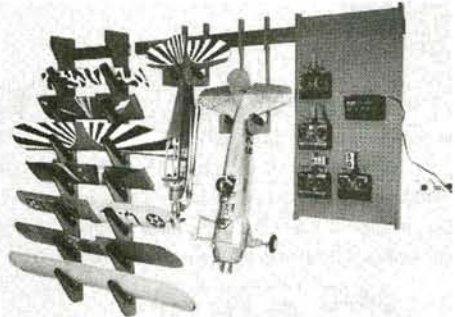
The two-piece hubs of the Dave Brown wheels pull apart, with one side sliding inside the other. In their original state, the hubs are the same width as the tire material. If you wish to form balloon-type tires, you can trim material from the two plastic pieces which form the center of the hub until you get the proper rim width. I would suggest this as a last step, since taking the hubs in and out causes the tire to loosen eventually. If this occurs, the tire can more easily slip on the hub during the shaping process.

Now, go out and find that project with the wildly weird wheels and grind away to your heart's content! Oh yes, if you think balsa dust is a pain, just wait until you see that black foam dust all over your workshop (and face and hair, etc.!).

\*Addresses are listed alphabetically in the Index of Manufacturers on page 123.

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# Scratch-Builders' CORNER

by GEORGE WILSON JR.

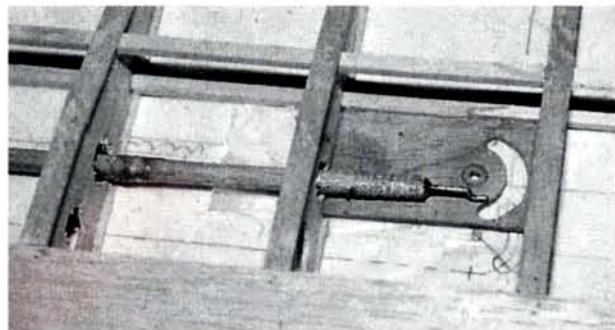
## CONTROL LINKAGE AND DIFFERENTIAL THROW

ONE OF THE joys of scratch-building is doing it "my way" (believe me, I don't sing well at all). Scratch-builders take pride in being original and innovative.

While I was building Rich Uravitch's Bronco, the needed bellcrank parts were not on hand, and innovation time had arrived. It is my practice to lay out/draw the aileron linkages (and many other things) in full scale to ensure that the parts and holes are properly positioned. Additionally, differential aileron

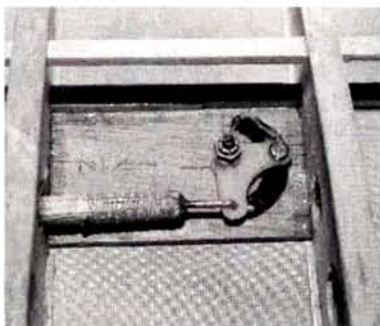
action was planned in this case, and this had to be checked out before construction began.

My favorite bellcrank installation is one that was taught to me by Hans Sagemuehl. This method requires a crescent-shaped hole to be cut in the

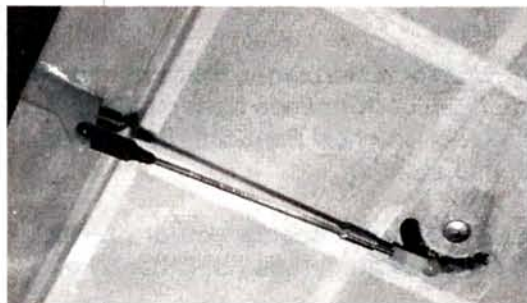


The bellcrank assembly shown in these photos was made using modified, commercially available hardware and is similar to those shown in one of the figures. Note that the pushrod end is also like one shown in the figures. Ends of this sort work well at least through 60-size models. This photo shows the pushrod before the bellcrank had been installed.

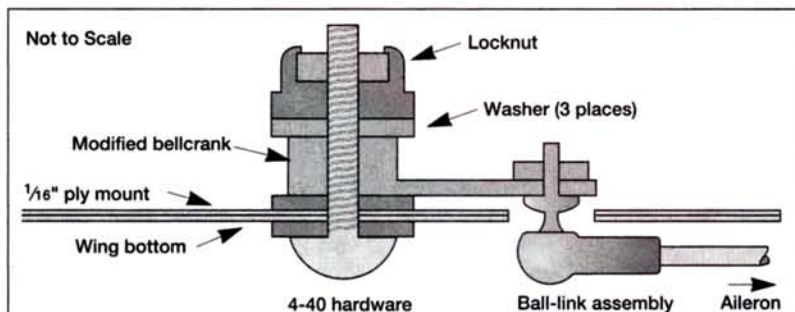
bellcrank mount on the bottom of the wing. The ball joints/links used on the bellcrank output arms project through these holes. This system provides all the flexibility needed for a neat and



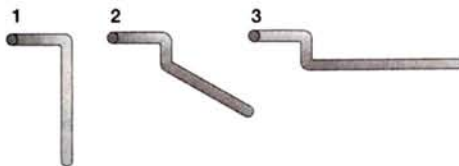
An interior view of the completed bellcrank. Note the locknut on top of the bellcrank pivot. The pivot is no longer accessible after the wing has been covered. Make sure things are tight and right before covering.



The exterior view of the bellcrank assembly and the linkage to the aileron horn. A ball joint/link is required at the crank end of the output linkage, but a clevis may be used at the horn. Note that the horn is set back on the aileron to achieve differential throw: more up than down.



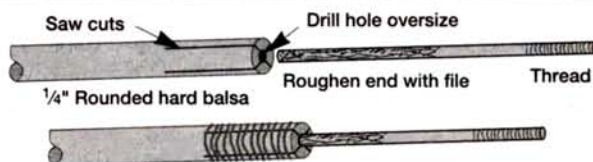
**Figure A.** The author's favorite aileron linkage shown in a cross-sectional view. (For clarity, the link to the horn is shown at right angles to its normal position.) The bellcrank output exits the bottom of the wing through a crescent-shaped opening and connects to the aileron horn with a ball link to provide the necessary degrees of freedom. The bellcrank is mounted on 1/16-inch plywood and is modified to remove the lower part of the crank bearing. (Crank with close bottom clearance are available.) This arrangement allows the ball joint to project below the bottom of the wing.



**Figure B.** The classic Z-bend can be easily bent using square-nose pliers. First, make a right-angle bend (1), then grasp the bend you just made, and bend the wire at right angles toward yourself (2) and, finally, still holding the wire as before, twist the wire to form the Z.

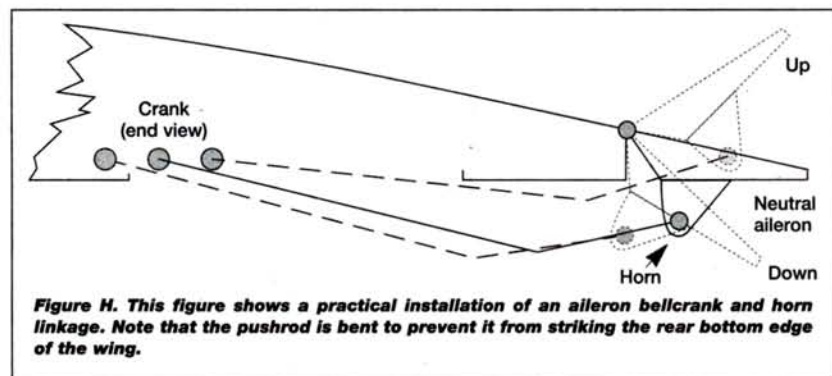
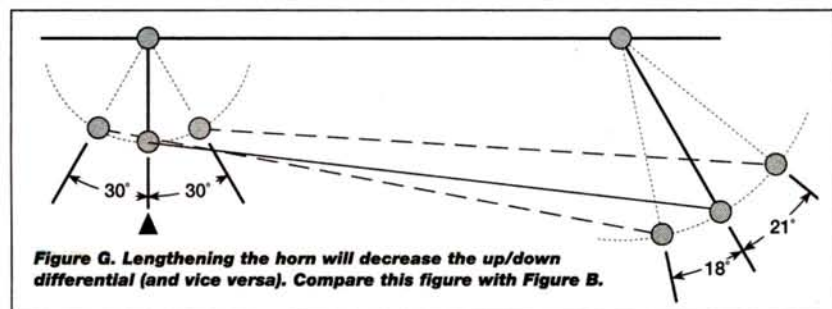
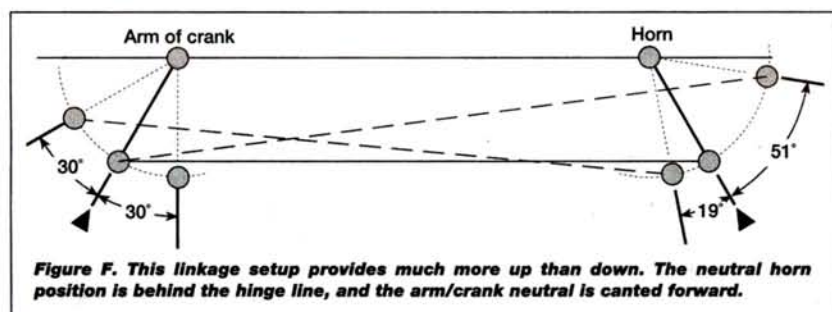
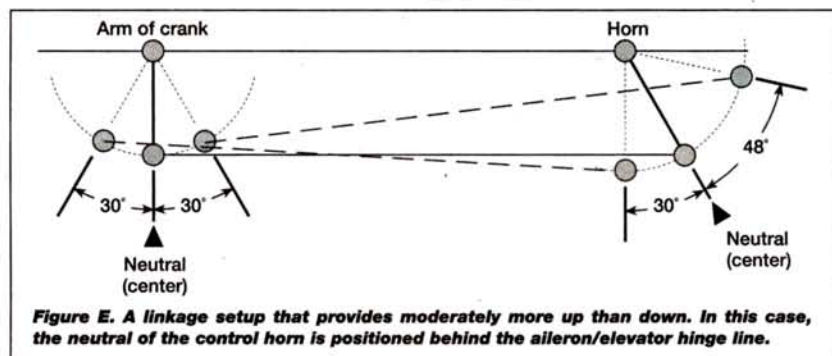
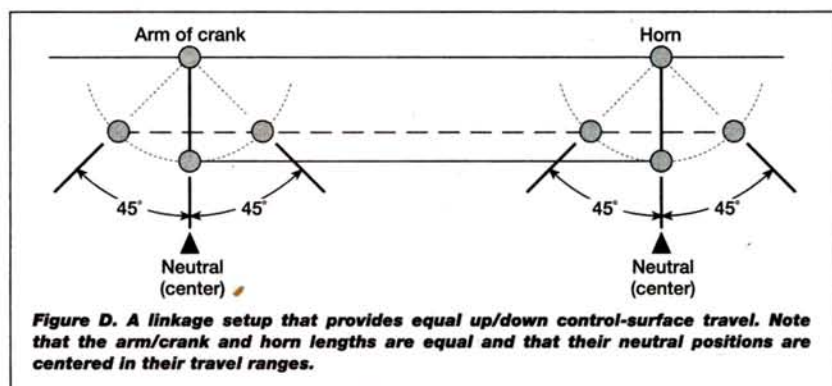
**Figure C.**

Pushrod ends may be made many ways. My favorite way is to drill a slightly oversize hole in the center of the rod end and then saw holes through the hole lengthwise with a razor saw. Rough up the end of the wire with a file or grinding wheel. Then coat it with epoxy, and insert it into the rod end. Finally, bind the rod end with thread and epoxy it.



Assemble with epoxy; wrap with nylon thread.



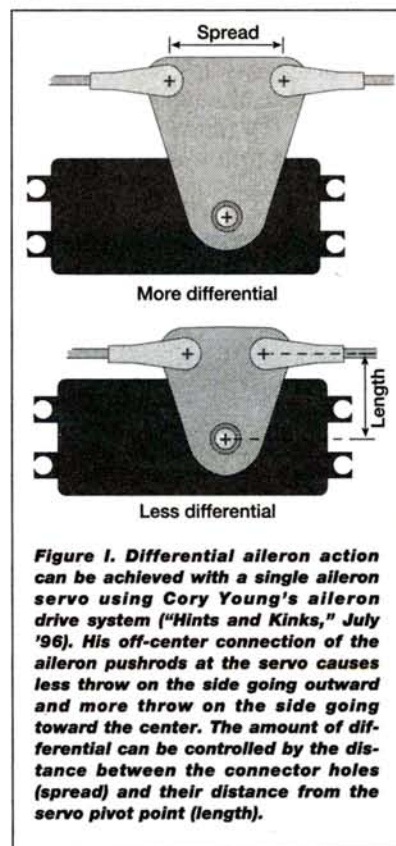


essentially slop-free linkage. Note that a ball-joint coupling was also used at the aileron servo. The photos illustrate the aileron outer linkage.

Ball joint/links are recommended for all linkage connections to minimize backlash/slop; however, clevises work very well in most applications. Screw-lock pushrod connections are controversial; some builders like them and others won't use them. If you use them, the newer ones with a socket-head screw and flat sides (hex or square) are recommended. This type of connector is especially helpful for throttle connections.

## MORE UP THAN DOWN

Without going into the aerodynamics of adverse yaw and why more up than down control action is advisable, ailerons frequently use this feature. This type of action is known as differential

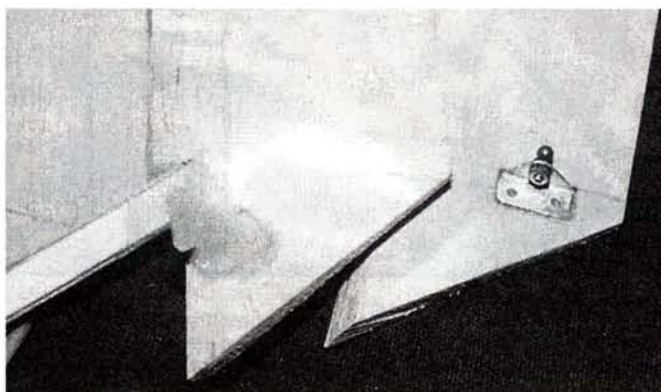


throw. In modern computer radios, this action may be programmed into the control setup; however, aileron differential can't be programmed unless separate aileron servos are used.

Although not as adjustable and convenient, differential throw can be (and has been for years) done mechanically. This involves the arrangement of the



There are many types and sizes of nylon hinges available from hobby suppliers. Scratch-made horns of plastic or metal are useful in many applications. The aluminum one shown here is part of the linkage that ties my Bronco's two rudders together. Note that the horns are cemented into the rudders, thus eliminating unsightly screws and nuts. A 1/16-inch-deep hole is rabbeted to fit the bases (use a no. 11 blade; it's easy to do). The bases are roughed up with coarse sandpaper, and the hole in the surface is filled with epoxy. The horns are pushed in, and epoxy is faired over the top of the base.



neutral settings and lengths of the servo arms, bellcranks and control horns.

The figures here illustrate how differential is obtained mechanically. In the elevator case, the servo and/or control horn are involved. In the aileron case, when one aileron servo is used, the bellcranks and control horns may be used. On the other hand, if two aileron servos are used, the method for each aileron is the same as that used for an

elevator. Reverse differential (which seems like a very unlikely requirement) can be attained by reversing the linkage arrangements shown in the figures.

Figures D, E and F illustrate the neutral settings for no differential through high differential. These figures show the basics. They use equal arm/crank/horn lengths. Varying these will change the differential. Typically, lengthening the horn, as shown in

Figure G, will decrease the differential and the throw. Figure H shows a practical application of aileron differential. Note that the rod connecting the horn is bent to clear the trailing edge. Figure I illustrates an aileron differential system that can be used with a single aileron servo and no bellcranks—typically, with coaxial pushrods. It is based on Cory Young's aileron drive system shown in "Hints and Kinks" (July '96 issue).





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### THE DESIGNER SPEAKS:

I am pleased to announce that my two newest planes, the **Speedy Bee** and **Lazy Bee Special**, are now available from Clancy Aviation. Both of my new Bees have ailerons and are truly a delight to fly! The hands-off stability, super-low minimum flying speed & sprung landing gear make for great flying and smooth landings. The oversize control surfaces and high power-to-weight ratio make for incredible aerobatics: Knife-edge flights, steep side-slipping descents, and turns without banking are now possible. Flying on windy days is a breeze! At a recent fly-in, my Bees won me the "Most Flights" award because it was just too windy for most other planes.

The new aileron wing has polyhedral on the bottom only - it is straight across the top. This novel wing design is stable while flying upright - but unlike conventional polyhedral wings, it is *not* unstable when flying inverted. Construction and covering is easy.

### SEEING IS BELIEVING!

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**-Andy Clancy**

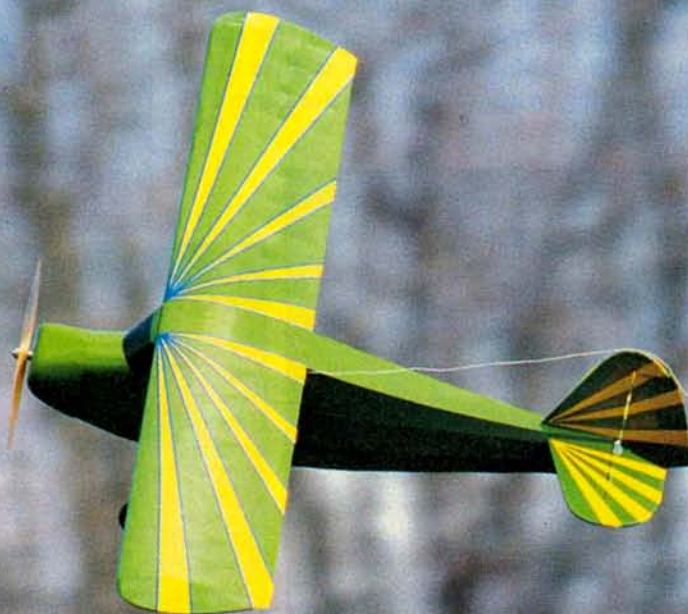
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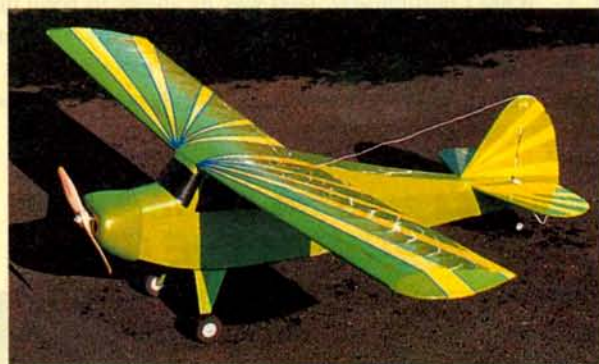
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Small-field  
fun



PHOTOS BY WALTER SIMS & DEBRA SHARP

CERMARK

# PORTERFIELD

ARF

IF YOU'RE LOOKING for a change of pace from the usual Cubs and Cessnas, Cermark's\* Porterfield ARF is a good choice. It's easy to assemble and comes in electric and glow versions. With the addition of Larry Marshall (an avid electrics flier) to the staff of Model Airplane News, we decided to review the electric Porterfield.

The model is a 3-channel, stick-built ARF that comes covered in either yellow, red or green film. It comes with a painted fiberglass cowl, wheels, instructions, window decals and hardware, including hinges, clevises, pushrods and struts. The landing gear comes painted and ready to install, and the pre-painted cowl has a prop-shaft hole and cooling holes already cut out.



## CONSTRUCTION

We started by installing the dihedral brace and epoxying the wing halves together (one half includes the center section). We

glued the plywood hold-down bracket into the slot on the wing with thin CA because the fit was very tight. The hold-down bracket comes with a hole already drilled that accepts a hold-down dowel that's already installed in the fuselage. To install the wing, simply place it on top of the wing saddle, slide the wing forward so that the dowel fits into the hole and install the aluminum wing hold-down bolt at the trailing edge. Make sure that you install the metal washer under the head of the bolt so the head won't dig into the surface of the wing.

Drill a hole in the leading edge of the rudder to accept the steering arm for the tailwheel, and screw on the tailwheel bracket. You can find the location of this hole by first screwing on the tailwheel bracket and seeing where the arm contacts the rudder's leading edge. Make sure that the hole is centered in the rudder's leading edge. Position the landing gear on the bottom of the fuselage, and mark and drill the holes for the attachment screws. Attach the landing gear and install the wheels (which are held in place on the axles with tight plastic retainers).

The tail assembly is next. The rudder, fin, hor-

## SPECIFICATIONS

**Name:** Porterfield

**Manufacturer:** Cermak

**Type:** sport-scale electric

**Wingspan:** 60 in.

**Wing area:** 511 sq. in.

**Weight:** 54 oz. (with motor system and battery)

**Radio req'd:** 3-channel (speed control, rudder, elevator)

**Radio used:** Futaba 6XVA with S-148 servos

**Motor req'd:** 100 to 150W electric motor

**Motor used:** Graupner 1716 (2.8:1 ratio)

**List price:** \$150

**Features:** quick assembly (ARF), balsa ply construction, complete hardware package that includes motor mounts, control linkages, wheels and manual.

**Comments:** this plane would make an ideal small-field flier. We flew our test flights from a soccer field surrounded on all sides with trees and had no problems.

### Hits

- Plane was very easy to assemble.
- Very easy to fly in small areas.
- Lightweight, yet strong construction.
- Motor mounting made easy by included mounts.

### Misses

- Battery area requires specific battery pack.
- One of our wing panels was warped.
- Wheels too small for grass fields.

## POWER SYSTEM FROM HOBBY LOBBY

There are many ways to power the Porterfield, but we wanted a system that could be purchased with a single phone call and that would be easy to install, because an oft-spoken criticism of electric power is that it's too complicated to do. With this Hobby Lobby\* system, it's simple to buy, simple to assemble and simple to install. In fact, it's a lot more simple than installing fuel tanks and throttle servos for a glow engine.

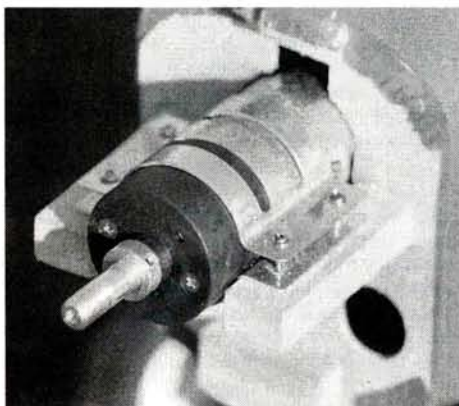
The motor system is a Graupner 1716 motor/gearbox combination (\$84.70). This 7-ounce wonder is actually the union of a Speed 500 (part no. GR1789) and a 2.8:1 planetary gearbox. The planetary gearbox is the secret to success here as it is of very high quality and, because there's no offset of the prop shaft, it's very easy to install in the Porterfield.

We used the JETI JES 30 speed controller (\$69) that can handle 6 to 10 cells and up to 30A continuous power. It comes with an on/off switch, which gives you control over power to both receiver and motor. It also includes a brake and BEC. The BEC has a shutdown announcement feature such that the motor is stopped momentarily and then restarted to give you a warning that "real soon now" the power to the motor will be cut to maintain a reserve for the receiver. The advantage of BEC in small planes like this is that your radio runs off the same battery as the motor, so you don't need a receiver pack in the plane.

We used seven 1700SCRC packs for power storage. These were packs I already owned and were assembled in side-by-side cell orientation. This proved a bit of a problem with the Porterfield, as the battery tray provides a very tight fit for packs made up end-to-end and was thus too narrow. Accommodating my packs required a bit of modification of the tray but that was done with a few minutes work.

A Master Airscrew\* 11x7 electric prop converted our motor power to thrust. These propellers have proven ideal for geared, sport applications.

This power system fits the Porterfield well, providing sufficient power for 8 to 9 minutes of sport flying. While static current draw is just a bit above 21 amps, the flight duration suggests an average current draw of only 11 to 12 amps, so the motor isn't working really hard. Thus, it should last a long time. If you want a bit more performance—trading off a bit of the duration—you might want to try an 11x9 prop. —Larry Marshall



Motor installation is simple, thanks to these aluminum clamps.

izontal stabilizer and elevator come covered and are ready to be installed. Making sure that it's straight, place the horizontal stab into the notch in the back of the fuse-

lage. Then mark and remove the covering where the stabilizer contacts the fuselage. Apply medium CA and then reinstall the stabilizer.

After the CA has dried, repeat the procedure for the vertical fin. Then hinge the rudder and elevator into place. The kit comes with hinges, but we used Sonic Tronics\* Nifty



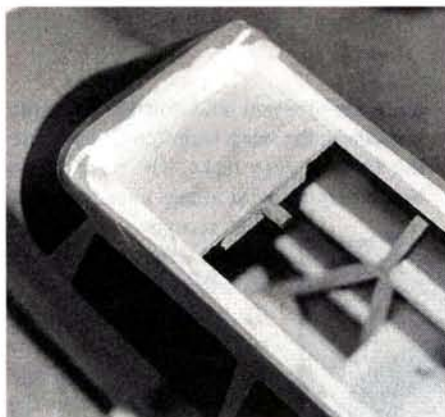
Lite hinges to simplify installation. It's really easy to CA these fabric hinges into place.

To dress the Porterfield up, we added a sunburst pattern using yellow MonoKote\* trim sheet and 1/8-inch Great Planes\* blue Kwik Stripe.

## RADIO INSTALLATION

We used a Futaba\* T6-XA radio with S-148 servos for elevator and rudder, and a Speed 500 motor with gearbox and JETI\* JES 30 speed controller with BEC to save weight (see sidebar).

We CA'd the servo mount plate to the



Left: the wing is attached with a plywood bracket that captures this dowel. Right: this plywood bracket holds the wing securely in place.



### • Takeoff and landing

Because of the small wheels on the Porterfield, it was impossible to do a normal takeoff from our soccer field test site. So, we hand-launched the plane. This proved an easy task as the plane is light enough, and the motor system powerful enough, that the plane simply flies out of your hand. No Herculean throwing efforts are required here.

We did have to dial in considerable right trim during the first flight. A more careful check of the aircraft (we should have done this before we flew) revealed that one wing panel was warped, resulting in the required rudder trim. In spite of this, the plane flew very well once trimmed and we had no further problems.

Landings were easy, as the plane slows down really well and will drift in very much like a sailplane. We had no problem landing within the soccer field area and this included doing all legs of the approach within the confines of the field. With the motor system we used, it was possible to easily get 8 to 9 minutes of enjoyable flight per charge.



### • High-speed performance

The Porterfield will never become known for its high speeds. Full-throttle speeds are, however, in the 40 to 50mph range, and it performs quite well at full throttle. We did a few horizontal 8s within the soccer field boundaries at full throttle, but within these confines, it's probably more reasonable to fly closer to scale-Porterfield speeds. But the plane is up to the task if required.

### • Low-speed performance

Being a lightly loaded (15 oz./sq. ft.) high-wing monoplane, the Porterfield has no problems with slow flight. In fact, it's downright majestic as it putts around overhead with only the prop noise to break the silence. Both rudder and elevator control remained good even at slow speeds. Power-off stalls were relatively sharp but recovery was easy.

### • Aerobatics

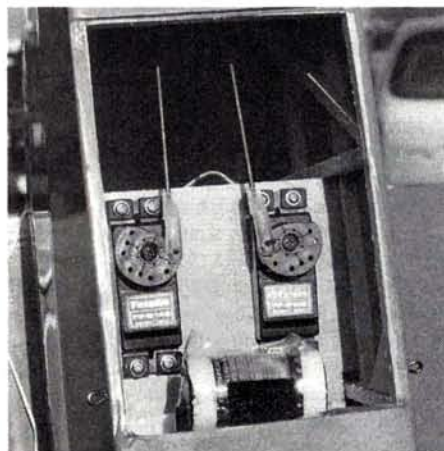
Looping the Porterfield is a simple matter of giving it some throttle, waiting for the speed to pick up and feeding in some up-elevator as it's got more than enough power to accomplish the task. Because it's a rudder/elevator plane, it's not up to axial rolls and such, but it will do a reasonable barrel roll and snap. In hindsight, we realize that we never tried to spin the plane, but we have no doubt that it would manage the task nicely.

side longerons in the radio compartment, and installed the elevator and rudder servos. Then we installed the control horns. The pushrods require a lit-

between the motor-mount beams to allow the motor to protrude into the fuse. Take the bottom motor-mount clamp and place it on top of the motor-mount rails. Mark and drill the mounting holes and install the motor and the mounting clamps. Lightly tighten the clamps to hold the motor in

place. To find the proper position of the motor, you have to first install the cowl. Slide the motor back and forth until you have enough clearance for the propeller. Remove the cowl and tighten the screws for the clamps.

Install the battery pack, connect the speed controller and check the CG location, which should be 2 1/2 inches from the leading edge of the



The servos are easy to get to through the hatch in the belly of the fuselage.

tle assembly before they are inserted into the fuselage and connected to the horns. With the servos and the control surfaces centered, mark and bend the pushrod wires so they match up to the servo-arm hole. Add the keepers to the wires and clip off the excess wire.

## MOTOR INSTALLATION

To fit the geared Speed 500 motor, you'll have to cut away the firewall

wing. We moved the battery pack forward to correct the CG.

## AT THE FIELD

The instructions say to install the struts before flight, but to reduce drag—and because the Porterfield's wing is strong enough to support the weight of the electric power system—we decided not to use them. All that was left was to charge up the batteries, grab the radio and go out to the field!

Intermediate sport fliers who don't want to spend a lot of time and effort at their workbench will appreciate the Cermak Porterfield ARF for its unique looks, its ease of assembly and its good flight characteristics. See you at the field!

\*Addresses are listed alphabetically in the Index of Manufacturers on page 123.



by BILL GRIGGS

## SCANOVER & AERODRAW

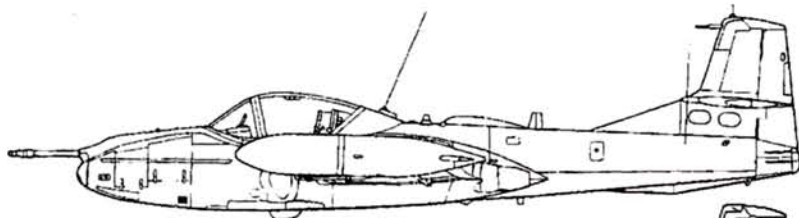
**H**ELLO, AND WELCOME to the second installment of "Cybernews." This month, I will be discussing Scanover and Aerodraw, two drafting aids from Windsoft Co.\*

### RASTER vs. VECTOR

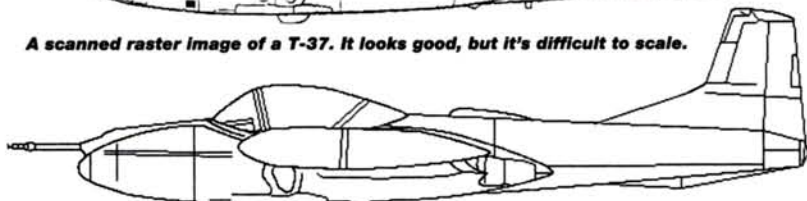
One difficulty in creating a scale-model drawing from a 3-view is ensuring that an accurate scale is maintained throughout the drawing. If you enlarge a 3-view drawing on a copy machine, you will notice that not

grams such as Corel Draw or Paintbrush as raster images. Raster images are stored in the computer as a list of color values for these pixels (dots). A raster drawing has no way of differentiating that a group of pixels is supposed to actually represent a line.

Computer Aided Design (CAD) drawing programs such as ModelCAD or AutoCAD use the vector method to store drawing information. A vector is a directional line, or the connecting line between two points in a coordinate system. Vectors use both a coordinate (location) and a direction to define a line. A drawing using a vector system would be more accurate because it takes into account the actual location of objects with respect to one another. Two lines drawn  $\frac{1}{16}$  inch apart will also print  $\frac{1}{16}$  inch apart.



*A scanned raster image of a T-37. It looks good, but it's difficult to scale.*



*Vector tracing of the scanned image. It looks even better, and this can be scaled without problems.*

only does the drawing get bigger, but the individual lines get fatter as well. This can allow dimensional discrepancies to creep in.

It would be great if there were a way to copy the 3-view drawing into the computer and automatically create a scale drawing from it. This generally won't work because of the method in which the computer stores image data.

Computer drawing programs use two major methods to store drawing images: raster and vector. A computer monitor displays graphics on its screen as a series of small colored dots. The dots are called pixels. Computers handle images created by drawing pro-

Raster drawings generally can't be used to accurately scale up a 3-view drawing because the number of pixels changes depending on the size of the drawing. Also as you blow up or enlarge a raster image, lines tend to lose their sharp edge (resolution) and become fatter, as in our photocopier example.

Changing the scale in a vector drawing is easy because the relationship of the objects in the drawing remains constant no matter what scale is used in the drawing. A line remains a line, and the thickness of the line doesn't change.

### SCANOVER

Scanover is a program that was created to bridge the gap between raster and vector drawing programs. This program allows you to take a scanned image (raster) and trace over it to create a vector drawing.

Computer scanners use a process similar to a copying machine to create an image on the computer. Unfortunately, drawings created by a scanner are raster drawings, so you can't just scan in a 3-view drawing and create an accurate model plan from it.

With Scanover, you can scan an image into the computer and then convert the image into a transparent layer inside the CAD program. The transparent layer itself can't be manipulated, but you can draw right over the lines of the transparency onto another layer.

Layers are tools that CAD programs use to separate the drawings into logical groups. For instance, on an airplane plan, all the radio gear might be on one layer and all the wood parts on another. Layers allow you to turn off parts of the drawing you aren't working with so that details that you don't need to see aren't displayed.

Scanover lets you trace the picture (raster) image and create a vector image. Once I have traced the image, I can turn off the scanned raster layer and then work with the resultant vector drawing layers. I am free to scale the drawing up to whatever size I desire. All the lines in the drawing will remain the proper thickness and distance with respect to one another.

Scanover is a very useful program. I have used it quite regularly for the past four or five years. Windsoft has versions of Scanover available for several different CAD programs.

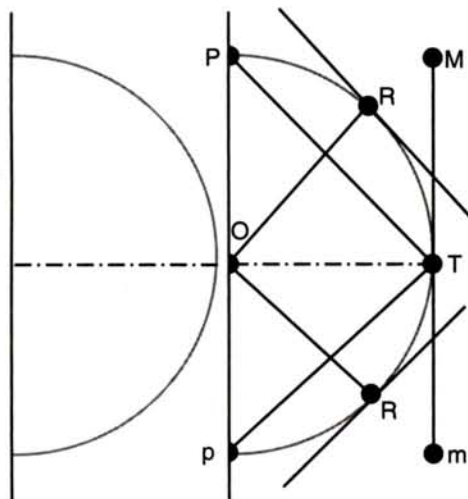
### AERODRAW

With Scanover, I had some difficulty accurately tracing compound curves. Windsoft created Aerodraw to solve this problem and further automate the drawing process. Aerodraw was designed to complement DesignCAD, the professional CAD program from which ModelCAD was derived. Aerodraw becomes a seamlessly integrated part of DesignCAD and can be run anytime DesignCAD is run.



Incidentally, if you are looking for a powerful CAD package at an attractive price, DesignCAD is a good choice.

Aerodraw uses a technique called conic lofting to generate cross-sections. Three-view drawings usually show two or three cross-section views at key points on the fuselage. You usually have to guess at the shape and size of formers between key points. Aerodraw removes the guesswork, as it can create formers at any point on the fuselage by using what it knows about the geometric relationship of the fuselage shapes at these key points.



**Figure 1. Scanned former (left) and two point-reference frames (PRFs) laid out over a former half (right).**

For Aerodraw to do its magic, it must have Scanover installed as well. Once both Scanover and Aerodraw are installed, they become an integral part of DesignCAD. Both programs have their own spot in DesignCAD's pull-down menus. Additionally, Scanover creates an icon-based menu for easy access to its commands.

To use Aerodraw, I first acquire a scanned image of the fuselage cross-sections. Next, I activate Scanover and Aerodraw from inside DesignCAD. These three programs working in conjunction have quite a formidable array of tools.

The vector drawing of the fuselage former is created over the raster image of the former. I create a point reference frame (PRF) for each section of the compound curve. Wherever the curve changes direction, I use a different point-reference frame. A point-reference frame consists of a series of right triangles, parallel and tangent lines arranged as seen in Figure 1. Aerodraw uses mathematical functions to determine the shape of the curves based

on the placement of the lines and triangles. It then automatically generates the points on the curve and creates the cross-sections.

Aerodraw instructions on creating PRFs are very thorough, but here's a brief description of the process. By realizing that each cross-section is split down its centerline, you can cut your work in half. Thus, the complete former can be made by creating a mirror image of your drawing of half the former. Refer to Figure 1 as I discuss the process.

To draw a PRF, you must first draw the centerline of the former. Set a point at the top of the former (P) and one at the bottom (p) then connect them with a straight line. Next set a point at the widest spot on the cross-section (T), and draw a perpendicular line from that point to the centerline at point (O). Then draw a line parallel to the centerline (P-p), through point (T). Label the upper point (M) and the lower point (m). This "H"-shaped group of lines is the basis for all PRFs.

Two right triangles are formed by connecting point (P) to point (T) and point (p) to point (T). Now we will refer only to the top half of our PRF. Please understand that each step is also done to the bottom half.

Draw a line parallel to line (P-T) that is just outside the curve of the former's scanned image. Next, set a point (R), directly on the curved line at its widest point. Draw a line between point (R) and point (O). Once these steps are completed for the bottom of the former, you are ready to draw.

Select Aerodraw from the menu and then select Frame. Simply follow the instructions on the screen and pick the points in the following order: O, P, R, T and M. Aerodraw will use your input, do a few quick calculations and then begin to draw the curve. Aerodraw can create hundreds of points along the curved line much better than I can with a mouse, and a whole lot faster.

For me, the real power of Aerodraw is its ability to create a series of formers based on just the information of two or three key points. You can specify where you want a former to go on your plan view. You can also specify how many formers you would like it to create and how far apart to space them. Each former created with this method will be the proper

shape to blend into the next.

Aerodraw has many more unique and useful features that I don't have space to mention. If you would like more information, contact Bob Holman Plans\*.



**The Electric Flyers Only logo as it appears on the homepage of Ken Myers' website.**

## WEBSITE OF THE MONTH

The website of the month is the Electric Flyers Only (EFO) homepage. Ken Myers is a well-known electric modeler and editor of "The Ampeer," an electric-only newsletter for "Electric Flyers Only," an AMA-chartered club that caters to electric modelers. Ken put together a first-rate homepage to help modelers easily locate information and products dealing with electric flight.

The EFO homepage is one of the best I have seen. Obviously, the state of Michigan thinks so, too, because the site has received an award as one of Michigan's best websites. The page has numerous links to other electric- and hobby-related websites.

While you are at the EFO site, feel free to download a copy of "The Ampeer" newsletter; it's a great example of what every club newsletter should be. I can't stress enough the Herculean effort Ken puts into his website and newsletter.

Ken also has several articles by Dr. Keith Shaw on designing electric aircraft. These articles are must-reads for those who want solid performance from their planes. There are also many photographs of electric planes from all over the planet. You should really check this one out at <http://members.gnn.com/kenmyers/homepage>.

Thanks to everyone who has written to me about this column. I appreciate the feedback and hope to be able to use some of your ideas. This column is designed to help you make better use of your computer.

I can be reached online at either of the following email addresses: CompuServe at 102341.2605@compuserve.com and America Online at griggsbill@aol.com. You can check out my homepage at: <http://ourworld.compuserve.com/homepages/griggsbill>. If you are cyber-impaired, write to me at: Bill Griggs, RR2 Box 64, Canastota, NY 13032.

\*Addresses are listed alphabetically in the Index of Manufacturers on page 123. ★



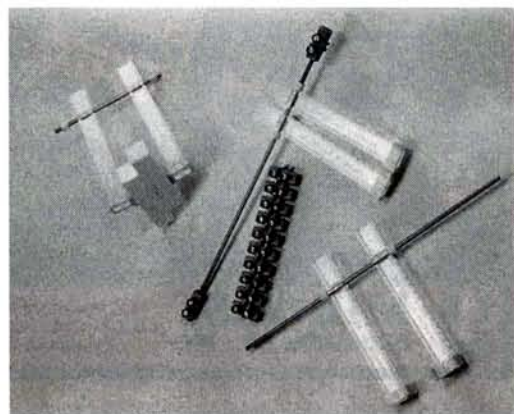
## LATEST PRODUCT RELEASES

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**Futaba Corp. of America,**  
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Irvine, CA 92718;  
(714) 455-9888;  
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These unique clamps come in a range of sizes that allow you to tackle from the smallest, most fragile task to the largest assembly project. They consist of a high-density, carbon-fiber beam, two polycarbonate jaws with soft, silicone rubber buffers and two stops that prevent the jaws from sliding off the beam.

**Zona Tool Co.,** P.O. Box  
502, Bethel, CT 06801;  
(203) 791-0487.

### DYNAMITE **Engine-Compression Gauge**

This gauge is made of high-quality materials and is designed to provide extremely reliable readings with accuracy within 1psi. It's easy to use; simply thread its stem into your engine's glow-plug socket and turn the engine over.

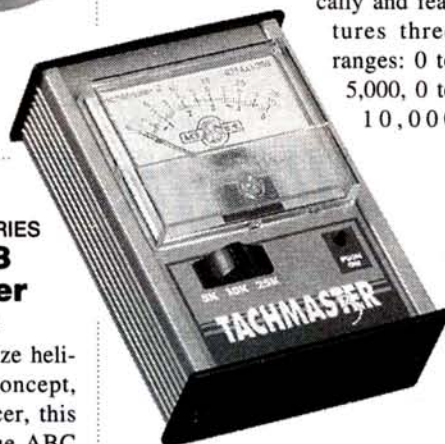
**Part no.—2514; price—\$44.95.**

**Dynamite;** distributed by Horizon Hobby Distributors Inc., 4105 Fieldstone Rd., Champaign, IL 61821; (217) 355-9511.



### ACE R/C **Tachmaster™**

The Tachmaster reads rpm optically and features three ranges: 0 to 5,000, 0 to 10,000



and 0 to 25,000rpm. Each range is color coded for easy identification. The unit has a "push on" switch and requires a 9V transistor battery (not included).

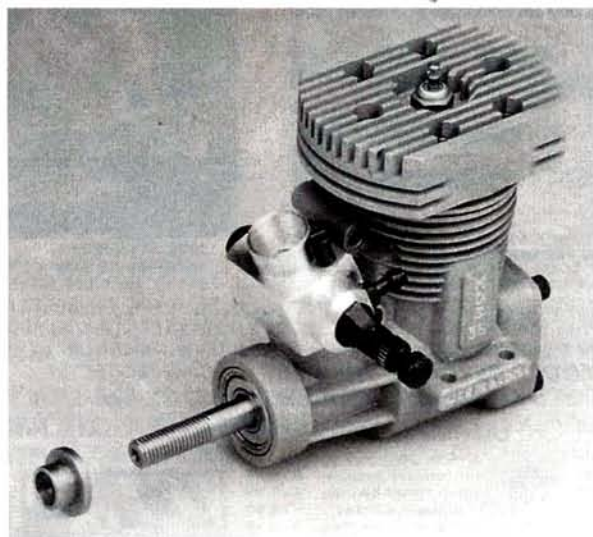
**Part no.—26K25; price—\$57.95.**  
**Ace R/C,** 116 W. 19th St.,  
Higginsville, MO 64037-0472;  
(800) 322-7121.

### ESTES INDUSTRIES **MDS .38 Helicopter Engine**

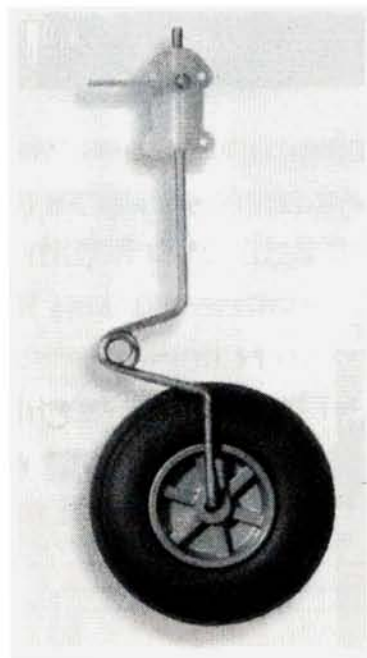
Designed for .30-size helicopters like the Concept, Shuttle and Enforcer, this engine features true ABC design, dual ball bearings, Schnuerle porting and the Aeromix™ twin-needle carburetor.

**Price—\$119.95**

**Estes Industries,** P.O. Box  
227, 1295 H St., Penrose,  
CO 81240; (719) 372-6565;  
fax (719) 372-3419.







#### SULLIVAN PRODUCTS **Nose Gear**

This new nose gear is made out of standard 3/32-inch music wire with a special "knuckle" design to absorb shocks. It features an extended leg for more adjustment range and comes with a bearing block, a steering arm and hardware.

**Part no.**—S865, **price**—\$3.95.  
**Sullivan Products**, One N. Haven St., Baltimore, MD 21224.

#### NEW BOY RC DISTRIBUTORS **Z-Best Engine Cleaner**

This product will thoroughly remove all burned-on fuels and varnishes that have accumulated on your engine, leaving a clean, bright, metal surface. It will not harm rubber or plastic parts. The newly designed cap features a built-in brush applicator.

**New Boy RC Distributors**, 355 N. York Rd., Willow Grove, PA 19090-0188; (800) 423-0175 or (215) 659-9255.

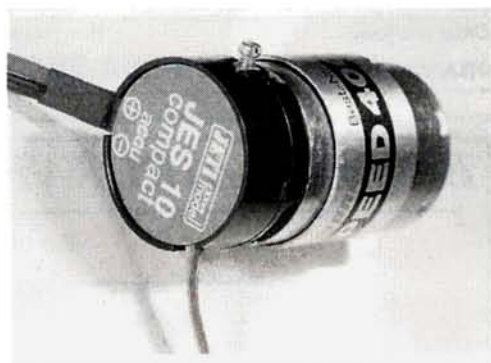
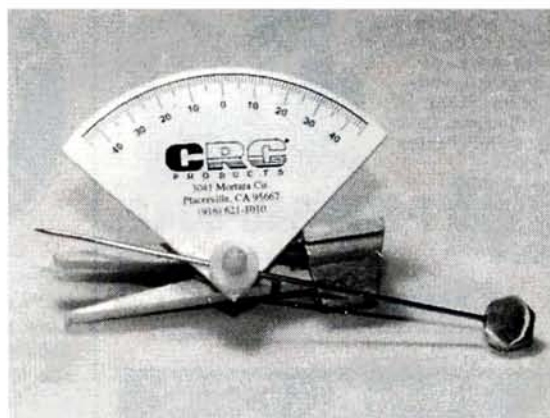


#### CRC PRODUCTS **Control-Surface Deflection Meter**

This handcrafted device allows you to match ailerons and elevator halves, adjust ATV and DR limits and remember degrees of throw when you replace servos. It can be clipped onto any control surface.

**Price**—\$24.99

**CRC Products**, distributed by R/C City, 215 Industrial Blvd., Tullahoma, TN 37388; (615) 455-0735; fax (615) 455-0677.



#### HOBBY LOBBY INTL. **Jeti JES 10 Compact**

This control uses setscrews to clamp to any Speed 400 motor's connectors. For 6 or 7 cells, max; 10 amps; 1 1/8-inch diameter; 0.7 ounce. It has a brake, BEC and high rate efficiency. Motor start point is adjustable.

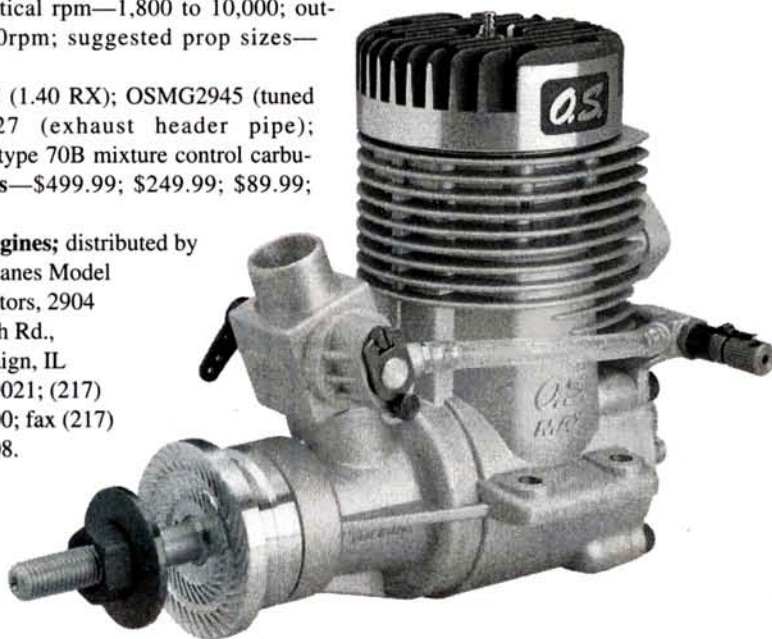
**Part no.**—HLJE10C; **price**—\$41.90.  
**Hobby Lobby Intl.**, 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444; fax (615) 377-6948.

#### O.S. ENGINES **1.40 RX 2-Stroke**

This powerplant is specifically designed to deliver the power and performance that are demanded in FAI and F3A competition. Its features include a needle valve that's mounted at the rear of the crankcase, a new type 70A carburetor and a new integral fuel pump that provides positive, even fuel delivery regardless of aircraft attitude. Specifications: displacement—1.404ci; bore—1.260 in.; stroke—1.126 in.; practical rpm—1,800 to 10,000; output—3.5bhp per 9,000rpm; suggested prop sizes—15x14, 16x16.

**Part nos.**—OSMG0678 (1.40 RX); OSMG2945 (tuned silencer); OSMG2727 (exhaust header pipe); OSMG2545 (type 70B mixture control carburetor); **prices**—\$499.99; \$249.99; \$89.99; \$99.99.

**O.S. Engines**; distributed by Great Planes Model Distributors, 2904 Research Rd., Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-0008.



Descriptions of products appearing in these pages were derived from press releases supplied by their manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by **Model Airplane News**, nor does it guarantee product performance. When writing to the manufacturer about any product described here, be sure to mention that you read about it in **Model Airplane News**. Manufacturers! To have your products featured here, address the press releases to **Model Airplane News**, attention: Product News, Air Age Inc., 100 East Ridge, Ridgefield, CT 06877-4606.



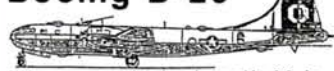
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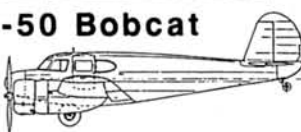
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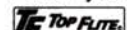
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**AstroFlight Inc.**, 13311 Beach Ave., Marina Del Rey, CA 90292; (310) 821-6242; fax (310) 822-6637.

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**Bill Griggs Models**, RR2 Box 64, Canastota, NY 13032; (315) 697-8152.

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**Dave Brown Products**, 4560 Layhigh Rd., Hamilton, OH 45013; (513) 738-1576; fax (513) 738-0152.

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**Du-Bro Products**, P.O. Box 815, Wauconda, IL 60084; (708) 526-2136; fax (708) 526-1604.

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# Name **THAT PLANE**

## CAN YOU IDENTIFY THIS AIRCRAFT?

If you can, send your answer to *Model Airplane News*, Name That Plane Contest (state issue in which plane appeared), 100 East Ridge, Ridgefield, CT 06877-4606.



Congratulations to Jake Jacobs of Duncanville, TX, for correctly identifying the December '96 mystery plane. Featured on the cover of the June 1948 issue of *Model Airplane News*,

equipment, but it could "take care of itself in an argument" with standard aircraft rockets and a few other rockets that were useful for handling surface vessels. ✚

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to *Model Airplane News*. If already a subscriber, the winner will receive a free one-year extension of his subscription.



the Grumman XTB3F-1 was billed as an "all-weather combat plane." The prototype 3F-1 was powered by a Pratt & Whitney Double Wasp reciprocating engine in the nose and a Westinghouse 19B axial-flow turbojet engine in the tail—a combination that produced about 4,000hp at maximum speed. Because of its long-range search mission, the 3F-1 was lightly armed with only two 20mm cannons as fixed standard



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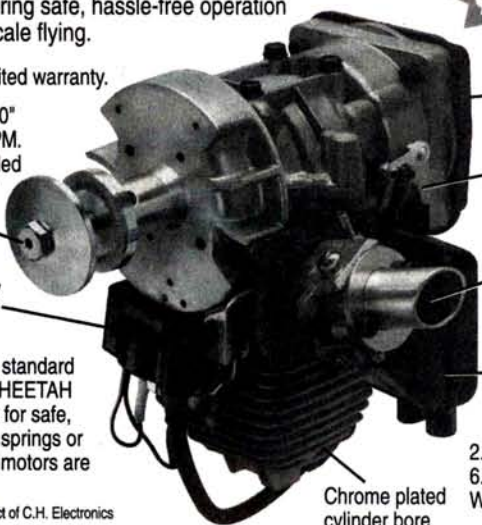
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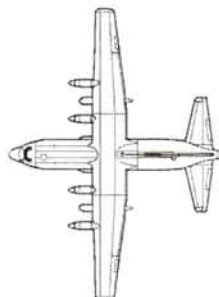
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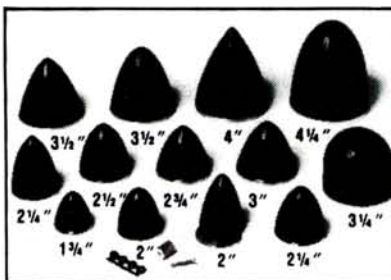
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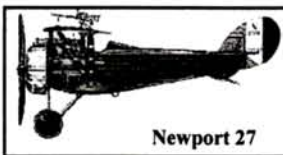
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# Final **APPROACH**

## WHY NOT WINGLET?

**"D**rag is the enemy!"—a battle cry of sailplane designers. One of the most persistent drag-reduction problems in aero design is the vortex formed at the tip of a wing in flight.

The design weapons available to fight tip vortex drag include planform, aspect ratio and tip devices. In "Model Aircraft Aerodynamics," Martin Simons explains, "When a wing is mounted so that it completely bridges the walls of a wind tunnel, no tip vor-



Two-meter Spica design at Visalia, October 1996.

trices form. The wing then behaves as if it had infinite aspect ratio and the vortex-induced drag is nil."

Tip plates have been fitted in an attempt to reproduce the drag-reducing effect of the wind-tunnel walls, but tip plates large enough to show a desirable effect are too large to be practical. Another strategy is winglets.

Winglets are small, nearly vertical wing-like surfaces mounted at the wingtip. Developed by Richard Whitcomb of the NASA Langley Research Center, they have been widely accepted in full-scale, commercial aviation but are uncommon in model aviation.

Simons explains that tip plates and winglets operate on different principles. "A tip plate is intended to restrict or prevent the tip vortex. Winglets and tip sails are designed to use the vortex

by extracting some of its energy."

Simons concludes by saying, "As far as model aircraft are concerned, very few tests have been performed with winglets or tip sails," and mentions but one report, that written by Chuck Anderson.

Chuck Anderson first used winglets on a research model in 1976, has been developing them ever since, and currently flies his 2-meter Spica design in thermal duration competition.

I flew with Chuck at the 1996 AMA Nats and again at Visalia. The casual observer at these meets saw that *not a single other sailplane* used winglets. The careful researcher notes that Chuck has been flying with winglets for 20 years. What gives?

Anderson, a military pilot and an aeronautical engineer, retired after 32 years of designing and working with USAF wind tunnels. I discussed with him his experience with winglets on model aircraft.

I asked about the advantages and disadvantages of winglets, and Chuck replied, "Winglets reduce the strength of the tip vortex and are equivalent to increasing wingspan. Winglets also allow longer chord lengths to be used on span-limited models

without incurring an excessive drag penalty because of the low aspect ratio. Also, the increased side area makes the model much easier to see."

"The main disadvantage of winglets is sensitivity to gusts, especially when landing. Winglets can be optimized for only a narrow speed range. Winglets must be carefully aligned to give optimum performance at the desired airspeed."

I asked why their use on models is rare, especially given their acceptance in full-scale aviation, and Chuck explained, "Winglets are not understood by most modelers. They are one more thing to adjust and many people do not want to take the time to optimize winglets. Finally, they are not in fashion. No big name modelers are using them. Look how long it took V-tails to become fashionable."



Chuck Anderson launches his 2-meter Spica in 1979.

When comparing winglets with other vortex drag-reducing methods, Chuck said, "Increasing span is a better method. Computer programs also help to lay out the wing planform to optimize lift distributions. Both are easier for modelers to understand and implement."

He explained other considerations: "Designing winglets is just like designing wings with allowances for the complex circular flow field in which they operate. It is essential that an effective airfoil be used. The small chord lengths reduce the Reynolds number to a level below the critical number of many popular airfoils. Hand-launch airfoils would be good for winglets. The winglet angle of attack (AoA) must be adjusted to allow it to operate below the stall AoA. The flow field generated by the tip vortex results in an inflow above the wingtip. The vortex increases in strength as the wing AoA increases. The resulting increase in inflow above the wingtip increases the winglet AoA, which is the main reason winglets can be optimized for only a narrow speed range."

Chuck's final advice distinguishes between wingspan classes. "I would never build a 2-meter model without winglets and would never use winglets on an unlimited class model. Increasing span is an easier and more effective way of reducing drag."

—Dave Garwood ✦

#### REFERENCES

1. Richard Whitcomb, "A Design Approach and Selected Wind Tunnel Results at High Subsonic Speeds for Wing-Tip Mounted Winglets." NASA TN D8260, available from the National Technical Reference Center.
2. Martin Simons, *Model Aircraft Aerodynamics*, 1987 Argus Books, Ltd., London
3. Chuck Anderson, "Winglets - Are they Worth It?", *Model Aviation*, May 1980.